D 101.52/3:9/3

ARMY RESEARCH AND DEVELOPMENT

MONTHLY NEWSMAGAZINE OF THE OFFICE OF THE CHIEF, RESEARCH AND DEVELOPMENT
Vol. 9 No. 3 • March 1968 • HEADQUARTERS, DEPARTMENT OF THE ARMY • Washington, D.C.

UNIVERSITY OF FLORIDA LIBRARIES DOCUMENTS DEPT. APR 2 1968

DASA (R&D) Chosen As Dual ABMDA Head

Creation of the U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA), involving transfer to it of a major portion of the Advanced Research Project Agency's Project Defender, was approved Feb. 8 by the Deputy Secretary of Defense.

Director of Project Defender, Dr. Patrick J. Friel, and about 10 key members of his staff are involved in the transfer. Dr. Friel's new titles are Deputy Assistant Secretary of the Army (R&D) for Ballistic Missile Defense, and Director of ABMDA.

In his role as DASA (R&D) for Missile Defense, Dr. Friel will act as primary adviser to the ASA (R&D) for development of police guidance on the Army's Advanced Ballistic Missile Defense Program.

In his capacity as Director of ABMDA, Dr. Friel will report to the Chief of Research and Development and be responsible to him for the technical management, direction and control of ABMDA, a Class II activity, Office of the Chief of R&D.

The ABMDA is an outgrowth of

(*Continued on page 5*)

OCE Establishing Construction Research Lab

Authority to proceed with establishment of a Construction Engineering Research Laboratory (CERL) for the U.S. Army Corps of Engineers, involving erection of three large buildings at 2-year intervals, has been announced by Chief of Engineers Lt Gen William F. Cassidy.

Under an annual renewal lease agreement with the University of Illinois Foundation, the laboratory will be located near the university campus at Interstate Research Park, Urbana-Champaign. Phase I of the 3-part project will be completed in the spring of 1969, General Cassidy said.

Selection of Lt Col Rodney E. Cox, who has a PhD degree in engineering, as the first director of the CERL also was announced. Tentative plans call for a staff of about 400 professionals, part of whom will be transferred from the Corps of Engineers Ohio River Division Labs (ORDL). Recruiting of additional personnel is under way.

Planned to complement construction research conducted by the Corps of Engineers at other facilities, the new laboratory will be unique, it was explained, in that it will be the first to apply the systems approach to the total construction process.

Research will be conducted in design engineering, construction techniques, materials and construction equipment. The Corps also plans to

(*Continued on page 3*)

AR Redefines Policies For Managing Labs

Management policies pertaining to research and development centers and to laboratories throughout the Department of the Army are prescribed in Army Regulation 705–55, published Jan. 17, 1968, as an extensive revision of a 1962 regulation.

Redesignation of a number of installations is expected to follow, in that one of the major changes calls for R&D Centers as distinguished from Laboratories. Authority and responsibilities of a laboratory director are also specifically defined, including criteria for appointment of civilian scientists vis-a-vis highly qualified officers.

An R&D Center is a "designated complex of laboratories and ancillary activities which is headed by a

(*Continued on page 2*)

CRREL Drillers Hit Antarctic Icecap Bedrock

Icy clues to cataclysmic happenings in the evolution of the world aeons ago, taken by U.S. Army researchers who drilled recently to bedrock 7,101 feet below the Antarctic Icecap, are being analyzed for possible answers to some of the most complicated mysteries of man's environment.

Bedrock at Byrd Station, one of the world's most remote scientific outposts, located about 700 miles

(*Continued on page 4*)

CRREL engineer Herbert T. Ueda positions drill head for descent to trace 30,000 or more years of history at Byrd Station, Antarctica. Bedrock below the icecap was reached Jan. 29.

Featured in This Issue . . .

Inter-American Defense College Educates Officers of 22 Nations ---- p. 8
Mosquitoes Prefer VC Tunnels to Swamps as Dry Weather Retreat ---- p. 11
Combat Service Support System Tests Set for May ---- p. 12
3 Young Americans Score at Japan Science Awards ---- p. 14
RDT&E, Procuremcnt Contracts Exceed $491 Million ---- p. 16
Army Scientific Advisory Panel Studying Reduction of Lead Time ---- p. 17
Engineer Corps Claims Largest Force of Construction Talent ---- p. 18
Garand Rifle Inventor's 54 Patents Set Goal for Rivals ---- p. 21
Army Board OKs $40 Million Water Resources Program ---- p. 28
Patent Processing for Federal Government Inventors ---- p. 31
Army Evaluatcs Amphibious Troop Carrier for Marine Corps ---- p. 36

Composite Torso Armor Classified 'Standard A'

"Form fitting" torso armor to protect crews of low-flying aircraft in Vietnam from ground fire was standardized recently after more than five years research and development of lightweight composite materials.

A hard-faced composite (HFC) — ceramic facing material bonded to reinforced fiber glass—was type-classified "Standard A." This major step is rewarding to more than a score of Army agencies and private firms involved in the Army armor R&D program.

The action served to quicken the pace for industry to produce the thousands of HFC protective vests needed, and to encourage researchers in Army laboratories to push ahead in developing improved personnel and aircraft armor.

(*Continued on page 6*)

UNIV. OF FLORIDA LIBS.
DOCUMENTS
DEPARTMENT
U.S. DEPOSITORY

Army R&D Newsmagazine

Vol. 9 No. 3 • March 1968

Editor . . . . . Clarence T. Smith
Associate Editor . . . . George J. Makuta
Assistant Editor . . . . . Read Wynn
Editorial Assistant . . . . . Dorothy Beck

Published monthly by the Army Research Office, Office of the Chief of Research and Development, Department of the Army, Washington, D.C. 20310, in coordination with the Technical and Industrial Liaison Office, OCRD. Grateful acknowledgment is made for the valuable assistance of Technical Liaison Offices within the U.S. Army Materiel Command, U.S. Continental Army Command, Office of the Chief of Engineers, and Office of The Surgeon General. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army June 6, 1967.

Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

Picture Credits: Unless otherwise indicated, all illustrations are by the U.S. Army.

Submission of Material: All articles submitted for publication must be channeled through the technical liaison or public information officer at installation or command level.

By-lined Articles: Primary responsibility for opinions of by-lined authors rests with them; their views do not necessarily reflect the official policy or position of the Department of the Army.

DISTRIBUTION is based on requirements submitted on DA Form 12-4. Army agency requirements must be mailed to the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220.

Distribution on an individual name basis is restricted to members of the U.S. Army Atomic Energy and R&D Officer Special Career Programs. Members of the U.S. Army Reserve R&D Unit Program receive distribution by bulk lot sent to their individual units. Otherwise, distribution is made only to the Army installation, office or organizational element to which the requester is assigned.

CHANGES OF ADDRESS for AE and R&D Officer Special Career Program enrollees should be addressed to: Specialist Branch, OPXC, Department of the Army, Stop 106 Washington, D.C. 20315. Reserve R&D Unit members should contact: Special Assistant for Reserve Affairs, OCRD, Department of the Army, Washington, D.C. 20310.

OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington, D.C. 20310, ATTN: Scientific and Technical Information Division.

ALL NON-U.S. GOVERNMENT agencies, firms and organizations must obtain this publication through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Single copies sell for 20 cents. Subscription rates (12 issues annually) are: Domestic, APO and FPO addresses, $2.25; Foreign, $3.00

AR Redefines Policies for Managing Labs

(*Continued from page 1*)

director and performs research and development functions at a single location or within a specified geographical area. . . . Laboratories may be either functional elements of an R&D Center or separate laboratories reporting directly to a major command. . . ."

A further clarification is that a laboratory is "a distinct organizational unit responsible for research and/or development leading to increased knowledge of natural phenomena, new products, techniques and/or processes." The definition continues:

"It is an investigative and creative unit headed by a director and composed of a group of individuals with allied skills and knowledge working on a related group of R&D problems. It is of such a size that its director can exert relatively intimate technical and administrative direction over its operations."

Clearly stated is that research, development, test and evaluation activities "whose primary function is test and evaluation are not considered laboratories as defined herein, and will not be designated by that term. They may include, as a subelement, a laboratory division or branch which provides support to the test and evaluation mission."

When an R&D Center or laboratory is not collocated within headquarters of a parent command, the AR states, the director will normally be a military senior officer "scientifically or technically trained." He will have direct line authority for management of the activity and will exercise control over all elements.

A civilian may be appointed as director of an R&D Center reporting directly to a major command, or to a Department of the Army staff agency, "in an exceptional case where a unique combination of scientific and/or engineering background and technical leadership and stature is required."

When a civilian is appointed director, the deputy will be a military officer who will exercise command over the military element of the activity in addition to his regularly assigned duties.

Either a military officer or a civilian may be appointed director of an R&D Center or separate laboratory which is collocated with headquarters of a parent command, or of a laboratory which is part of an R&D Center. The AR empowers the director to delegate authority for technical programs or other matters as he deems necessary.

Assigned duties and responsbilities of the director include insuring the relevance of the center or laboratory program to Army needs and prescribed missions; also, translating planning objectives into a specific program, including activities under the In-House Laboratory Independent Research (ILIR) Program.

The director is responsible for personnel selection and assignment, supervision and evaluation, and provision and maintenance of facilities and support services. This includes technical liaison with other developing agencies, the Army scientific community, and establishing joint activities with universities.

Among additional duties of the director are: insuring the timely announcement and dissemination of program results; publicizing significant achievements of personnel; accomplishing long-range planning for future development of the facility; and providing plans and capability for future mobilization expansion.

Each director's staff may include one or more scientific advisers, carrying such titles as chief scientist, chief engineer or scientific adviser. These shall be senior civilian scientists who do not occupy a line management position in the chain of command.

Revision of AR 705-55 maintains the responsibilities assigned by the original 1962 regulation to the Chief of Research and Development for establishing and assuring execution of policies for the management and control of R&D Centers and laboratories, including Class II activities under his operational control.

Similarly, the responsibility and authority of developing agencies remain unchanged, including those of the CG of the Army Materiel Command, the Army Security Agency CG, the Chief of Engineers, The Surgeon General, and the CG of the Combat Developments Command.

Management of Army R&D Centers and laboratories, the AR states, "will foster a dynamic and productive program with that freedom of action conducive to attracting and retaining competent scientists, engineers and contractors." This will include maintenance of a listing of projects and tasks by priority at each center or separate lab level.

Stressed in the regulation is that "significant results can be achieved by giving scientists and engineers the responsibility for designing their own work plan, the resources re-

(*Continued on page 30*)

OCE Establishing Construction Research Lab

(*Continued from page 1*)

explore possibilities of rapid, economical construction methods to meet emergency situations created by national disasters and wartime devastation.

Phase 1 provides for a building that will contain 265,000 feet of floor space for laboratory and office use. Each of the second- and third-phase buildings will have about 100,000 square feet of floor space.

Increasingly complex military facilities have frequently demanded more advanced techniques than are currently available, even with the aid of the civilian construction industry, it was stated by way of explaining the background for the new laboratory.

In considering these highly sophisticated requirements, the Chief of Engineers directed that a study be made with the assistance of experts assembled from the Building Research Advisory Board of the National Academy of Sciences. Results confirmed the need for a continuous research program to support changing construction demands.

With the desirability of a Construction Engineering Research Laboratory validated clearly, the next question was whether to establish it in an existing facility or construct specially designed buildings.

Three considerations were involved in the decision: the Army's long-range research programs; the Army's immediate engineering investigations; and research for other agencies for which the Corps of Engineers performs construction, such as the vast public works program involving virtually all major federal agencies.

During the study of this problem, a number of universities proposed to build and lease a facility built to specifications of the Corps. Advantages of such an arrangement were obvious and numerous. Among the benefits are:

- Collocation with a major university's research facilities.
- Availability of the university's faculty for consultant services to provide laboratory personnel with technical assistance.
- Access to the university's library and computer facilities.
- Providing laboratory personnel the stimulus of a university environment, with opportunity for advanced study and part-time teaching.
- Introducing new and fresh ideas in considering solutions to military construction problems by hiring young scientists and engineers desiring to obtain advanced degrees by off-duty courses.

With the concurrence of the Department of the Army and the Secretary of Defense, letters were sent to 46 universities in April 1966 inviting proposals for a laboratory facility that could be leased to the Corps.

Twenty universities submitted proposals and the unanimous choice of a nonpartisan board of competent professional personnel was the University of Illinois.

The nature of research construction problems that will be considered by the CERL will be broadly diversified, as posed by the worldwide activities of the Corps of Engineers in meeting military requirements.

Among examples are hardened missile defense systems, such as the Sentinel System antiballistic missile network; soil stabilization and pavement research for heavy-wheel-load aircraft such as the AF C5A transport; and complex facilities of the National Aeronautics and Space Administration.

The organizational chart for the CERL provides for an Engineering Development Division consisting of Project Systems, Special Projects and Data Analysis Branches; and a Laboratories Division comprised of five laboratories—Construction Systems, Materials, Power, Environmental, and Test and Evaluation.

Army Awards Contract For Sentinel Site Work

In cooperation with the Sentinel System Office, Washington, D.C., the U.S. Army Corps of Engineers recently awarded a $4.9 million contract for site planning design of radar and missile-launching facilities for the first two sites of the national defense network.

The Sentinel System will be deployed against the threat of an intercontinental ballistic missile attack by Communist China. The sites will be distributed throughout strategic areas of the United States to provide defense of the entire nation, the Department of Defense has announced.

Announced by the Office of the Chief of Engineers, the contract to Ralph M. Parsons Co., Los Angeles, Calif., was awarded by the Huntsville, Ala., Engineer Division, headed by Brig Gen Robert E. Young. The firm has done considerable work on the Nike Zeus and Nike-X R&D programs which developed various components of the Sentinel System.

The contract calls for general site plans for missile launching sites (for the Spartan and Sprint) and for the design and specifications for the radar facilities. It does not provide for design of the electrical power plant, administrative structures, troop billeting and other support features of the sites.

General Young said the design will be used as a basic design for radar and launch facilities for all sites in the system. Other architect-engineer firms will be asked to adapt the design for the follow-on-sites and the additional facilities required.

Qualifications of Lt Col Rodney E. Cox as the first director of the Construction Engineering Research Laboratory include a BS degree in civil engineering from Virginia Polytechnic Institute (Blacksburg, Va.), a master's degree in highway engineering (1962) and a PhD degree in transportation engineering (1964), both from Iowa State University.

Registered as a professional engineer in the State of Iowa, he is a graduate of the Engineer School, Fort Belvoir, Va., and the Command and General Staff College, Fort Leavenworth, Kans.

Col Cox was commissioned in the Corps of Engineers after graduating from Virginia Polytechnic Institute. He has commanded troop units in Korea and Germany, directed contract construction projects in the Omaha (Neb.) Engineer District, and held staff officer assignments with the U.S. Army, Europe, and the Office of the Deputy Chief of Staff, Logistics, in Washington, D.C.

In 1965–66 he served in Vietnam, first as an engineer unit senior adviser to the Vietnamese Army and later as G–3 adviser to the II Vietnamese Corps. He has been awarded the Bronze Star Medal, Air Medal and Commendation Medal with OLC.

CRREL Drillers Hit Antarctic Icecap Bedrock

(*Continued from page 1*)

from the South Pole in a vast area of barren snow and ice, was reached Jan. 29. The feat climaxed drilling started in 1966 and conducted continuously since Nov. 1, 1967.

This phenomenal achievement of collecting cores of ice in 15-foot sections to a depth nearly 1½ miles below the icecap surface rewarded efforts of scientists and engineers from the U.S. Army Cold Regions Research and Engineering Laboratories (CRREL), Hanover, N.H. Core recovery exceeded 99.7 percent of footage drilled.

The project was conducted as part of the U.S. Antarctic Research Program administered by the National Science Foundation (NSF). The NSF also sponsored the project in which a CRREL team drilled 4,562 feet through the Greenland Icecap and rocky debris beneath in July 1966. (See October 1966 issue of this publication, page 35.)

Analysis of the cores may provide answers to many of the questions of scientists regarding how and when the Antarctic Icecap developed, since the cores constitute a vertical profile of polar history.

Precisely how many thousands of years of polar history are involved is still open to conjecture, and only painstaking analysis will provide the accurate answer. By some methods of computation of ice deposition at Byrd Station, the answer is about 48,000 years. Other scientists suspect a more realistic figure is several times higher.

Preliminary analysis at Byrd Station of cores taken at depths of 4,370 and 4,627 feet, where the ice is estimated from 10,000 to 14,000 years old, has resulted in tentative identification of volcanic ash.

CRREL scientists at Hanover will make a more detailed analysis to ascertain whether the material is volcanic ash and whether it was deposited as a result of worldwide or local volcanic activity.

Scientists said the last 18 feet of the cylinder before bedrock, consisting of dirty ice and rock fragments up to 2.5 inches, also appear to be volcanic debris.

CRREL Antarctic Project Director B. Lyle Hansen observed evidence of water at the interface of the ice and the rock surface. Slippage of the ice on the rock surface has prevented scientists from obtaining a core of the underlying material. However, cuttings will be analyzed to determine the nature of the rock.

As a result of pressure from the ice above, the density of the cores increased progressively with depth. Very brittle and fractured cores were obtained between 1,300 and 3,000 feet. Below this depth, the ice became softer. Below 3,900 feet, numerous cloudy bands up to one-half inch thick were discovered, believed due to shearing of the ice.

Anthony J. Gow, a CRREL glaciologist who is spending his ninth season in Antarctica, is making a preliminary analysis of the material. Detailed analysis of the cores will be made in laboratories in the United States and in various foreign institutions.

Scientists from the University of Bern, Switzerland, the University of Copenhagen, Denmark, the University of Brussels, Belgium, and the Smithsonian Astrophysical Observatory in the United States will cooperate in studies of the ice cores.

Only small portions of the 15-foot cores will be sent to the U.S. The remainder will be kept in plastic bags, carefully marked as to the depth at which they were taken, in cold storage at Byrd Station. Cores will be available to scientists for study upon request to the NSF

Since the frozen mass of the Antarctic Icecap contains about 70 percent of the world's fresh water, scientists hope to determine the relationship between Northern Hemisphere glaciation and that of Antarctica in the history of the ice ages.

Any significant future change in this great fresh water reservoir would affect man's environment by causing changes in sea level, rainfall, river flow and the lake levels.

Study of the ice cores will provide information on the rate of snow accumulation; rate of deposition of meteoritic particles; elements of the climatic history of the Southern Hemisphere; the physical and chemical properties of the ice and underlying material; and composition of the atmosphere at Byrd Station from ancient times, as recorded in the air trapped in the ice cores.

Byrd Station cores will be compared with the data from cores obtained from the Greenland Icecap. Included in these studies are Carbon–14 dating procedures used to determine the absolute ages of the ice at selected levels, research on solid particles recovered from the ice, and density and bubble-pressure measurements.

Analysis of the chemical composition of the ice cores will determine impurities and any significant variations in fallout since ancient times.

CRREL TEAM members who participated in deep-core drilling through both the Greenland and the Antarctic Icecaps are (from left) Herbert T. Ueda, mechanical engineer; B. Lyle Hansen, Antarctic project director; Donald Garfield, mechanical engineer.

Deep-core drilling began at Byrd Station Nov. 20, 1966, and ended for that season in mid-February 1967. The 8-man team, supervised by Herbert T. Ueda, a CRREL mechanical engineer, completed installation of the equipment and drilled to a depth of 740 feet.

When drilling was resumed in November 1967, with the start of the Antarctic summer, the team worked 24 hours a day and drilled an average of 100 feet a day.

Drilling machinery is located in an ice tunnel 20 feet below the surface, with a 70-foot drill tower resting on the snow above. The drill itself has no solid stem. The drill and motor are suspended together on a flexible electrical cable that is lowered into the hole. The bit brings up a continuous core four inches in diameter.

Much of the design work on the rig was done by Ueda and Donald E. Garfield, another CRREL mechanical engineer also in Antarctica. The rig was tested and perfected by CRREL during the Greenland project.

Other CRREL personnel participating in the recent Byrd Station project included Edward Parrish and five enlisted personnel, all graduate engineers: Sp/5 Robert L. Doescher, Sp/4 William B. Strange, Pfc Lawrence W. Strawn, Pfc Dominick J. Gianola and Pvt William L. Trenholm.

Scientists drilled near Byrd Station to a depth of 1,000 feet during 1957–58 and at Little American V (through the Ross Ice Shelf) to a depth of 846 feet during 1958–59. The recent achievement is thus the gratifying climax of a 10-year goal.

Army Creates Advanced Ballistic Missile Defense Agency

(*Continued from page 1*)

the Army's responsibilities for missile defense in two primary areas:

- Develop, produce and deploy by the early 1970s a defense against the Chinese Communist nuclear missile threat—the Sentinel System.
- Continue, at top national priority, R&D in ballistic missile defense so that the United States retains the option to deploy a system to counter more massive and sophisticated threats—the Nike-X Program.

In view of these considerations, the ABMDA mission will be to:

- Develop advanced modifications to the presently approved Sentinel System to ensure its continued effectiveness against the evolving threat.
- Develop concepts and technology required to achieve qualitative improvements in ballistic defense capabilities against the more massive and sophisticated threats.
- Direct the R&D required to provide the capability to protect the U.S. strategic offensive forces against a ballistic missile counterforce attack.
- Provide the data which assists in development and evaluation of the U.S. strategic offensive systems.

The ABMDA will be concerned with such problems as reentry discrimination, advanced radar technoloy, advanced interceptor missile technology, nuclear kill mechanisms, advanced data processing technology, advanced defensive systems concepts, and space defense technology.

In order to achieve effective coordination with the Sentinel System, the headquarters of the ABMDA will be collocated with the Sentinel System Office (SENSO) in the Washington, D.C., area. SENSO's field agency, the Sentinel System Command, will remain at Redstone Arsenal, Ala.

Execution of the Nike-X developmental effort currently is assigned to the Advanced Development Directorate of the Sentinel System Command. Redesignated as the Nike-X Development Office, the directorate will function as an ABMDA field agency under direction and control of Dr. Friel.

The organizational chart of the ABMDA calls for eight divisions staffed by PL–313 employees, supergrade civilian scientists, field grade officers and additional scientific and technical personnel.

ECOM's Atomic Clock Aids Frequency Measurement

"Ticking" more than nine times every billionth of a second, the "master atomic clock" of the Army Electronics Command at Fort Monmouth, N.J., is considered an advanced measuring device of the space age.

Technically known as a frequency measuring standard, the clock is comparable in stability to a regular timekeeping clock that would gain or lose only one second every 30,000 years.

The element cesium, whose atomic structure can be made to resonate at an unalterable rate of 9.1 gigacycles —a "tick" every tenth of a nanosecond—is the heart of the atomic clock. Operated as a precise measuring standard, the clock is the central component of the ECOM primary frequency standards facility in the Hexagon Building.

Rated among the best in the country, the facility has an automatic switching system designed for rapid check-out, on a preset time sequence, of as many as 50 other highly precise standards. It has been used to evaluate new portable atomic standards instruments scheduled for installations of the Army, Navy, Air Force, and National Aeronautics and Space Administration.

Dr. Friel Named DASA (R&D) for Ballistic Missiles

Dr. Patrick J. Friel, newly appointed 40-year-old Deputy Assistant Secretary of the Army (R&D) for Ballistic Missiles, has distinguished himself in research, academic, industrial and U.S. Government work.

Graduated from Villanova University in 1950 with a BS degree in chemistry, he earned master's and doctoral degrees in physical chemistry from the University of Pennsylvania (1952–54).

While studying for his MS degree, he was a research assistant to Prof. K. A. Krieger on a contract sponsored by the U.S. Atomic Energy Commission, and later an assistant instructor in analytical and electro-chemistry.

After four years with Sun Oil Co. as a research chemist, he joined the General Electric Co. staff as a supervisory engineer in 1958. He was concerned with physics in aerophysics and engineering operation, Missile and Space Vehicle Department, and in 1961–62 headed the department.

Dr. Friel in 1966 became the director of Ballistic Missile Defense, Advanced Research Projects Agency, Office of the Secretary of Defense, after four years as manager of the Aerospace Physics Laboratory, Reentry Systems Department, GE Co.

Listed in *American Men of Science*, Physical and Biological Sciences (11th edition), he is the author of 15 technical publications on a variety of subjects. Included are low-temperature and surface reactions of free radicals, combustion engines, the thermodynamic properties of dissociated water vapor, electrical properties of contaminated air mixtures, reentry communications, ablation of plastics, and the radiation and radar detection of reentry vehicles. He also has been granted four patents.

In 1946–47, he was a sergeant in the U.S. Army with Cannon Co., 38th Infantry Regiment, 3d Infantry Div.

Dr. Patrick J. Friel

Reserve RDT&E Symposium Slated Sept. 15-28 at Belvoir

High-ranking leaders of Army Research and development are expected to participate in the 11th annual U.S. Army Reserve Research, Development, Testing and Engineering (RDT&E) Symposium, Sept. 15–28, at the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va.

Formerly titled the R&D Seminar for Reserve Officers, the 2-week gathering is sponsored by the 1621st Reserve Training Unit (Research) at the MERDC. Commanding officer of the unit is Col Adolph H. Humphreys, civilian chief of the Combat Research Division of the MERDC Military Technology Laboratory.

Emphasis at this year's symposium will be on engineering developments for the war in Vietnam. The symposium is arranged to provide selected Reserve officers with information on R&D programs at the MERDC and also at the U.S. Army Engineer Topographic Laboratories, the Night Vision Laboratory and the Nuclear Power Field Office.

Torso Armor Type Classification Climaxes 5 Years of Research

(*Continued from page 1*)

The aircrewmen's new armor system consists of a cloth garment with large pockets at the front and back. The curved HFC panels are inserted into the pockets front and back, or front only. The cloth carrier has padded shoulders, adjustable loops and a quick-release device for emergency removal.

The need for body armor was emphasized during the early 1950s in the Korean War. A wound casualty survey team from the Office of The Surgeon General (OTSG) determined that 80 percent of the wounded or killed in action were casualties of grenade, mortar or artillery shell fragments.

A ballistic nylon cloth vest was devised for US. troops in Korea. Caualties from fragmentation dropped 55 percent, according to an OTSG report. At that time, however, no materials were available to provide significant protection against small-arms fire within the weight range that a soldier could wear without affecting his combat performance.

The HFC armor for pilot, crew chiefs and gunners has *not* been approved by the Army for general use. Developers say this type of armor is excellent when the wearer is "more or less in a static position," such as in an aircraft. The weight problem still exists for the foot soildier, though it is believed surmountable.

The steel helmet used in World War I was improved before World War II. With additional refinements for use in Korea and Vietnam, it was practically the only protection then available for U.S. Army foot soldiers —because of the weight factor of materials.

In World War II, however, a cumbersome flak-protective vest of overlapping metal plates, in combination with layers of cloth, was developed and used extensively by Army Air Corps bomber crews.

UH-1B/D Armored Pilot Seat

With increased Army helicopter participation in the Vietnam action, the Department of Defense in 1962 authorized an ad hoc committee of experts to assess armor needs in Vietnam. The surprisingly high loss rate of helicopters was caused mainly by heavy concentrations of small-arms fire from the ground.

The study group reported an immediate need for personnel and aircraft armor. Members represented the Army Aviation Material Laboratories (AVLABS), Fort Eustis, Va.; the Ballistics Research Laboratories (BRL), Aberdeen (Md.) Proving Ground, and other federal agencies.

In response, AVLABS developed the "tipping plate" system installed in early helicopters such as the CH-21, UH-1, CH-34 and others. The composite steel plates would "tumble" small-arms hits so the projectile impacted after yawing 90 degrees. The system was considered a breakthrough because the weight was only about one-half that of homogeneous steel.

Another product resulting from the group's Vietnam visit was a pilot-copilot chest protector of a fiber glass material. It rested on the thighs and was held in place by a shoulder harness. Although effective, it was so uncomfortable pilots often did not use it.

Goodyear Aerospace Corp. in 1963 was one of the first firms to develop a composite ceramic armor of aluminum oxide in 6-inch square tiles bonded to a backup material.

General Frank S. Besson Jr., Army Materiel Command CG, was briefed in 1964 on the overall armor situation. He subsequently directed that AMC agencies develop body armor that aircrews could tolerate.

The U. S. Army Natick (Mass.) Laboratories (NLABS), working

Besson Assigns Cobey as STAAS Project Manager

Project manager responsibility for Army Materiel Command Surveillance and Target Acquisition Aircraft Systems (STAAS) has been assigned by General Frank S. Besson Jr. to Col Earl J. Cobey, who succeeds Brig Gen Lloyd L. Leech Jr. in this position.

Col Cobey also will serve as chief of the Combat Surveillance and Target Acquisition Systems Office, Army Materiel Command, with responsibility for determining requirements, capabilities, development of materiel, procurement and related matters.

During World War II, Col Cobey served in India and helped to provide communications along the Burma Road into China. He later served on General MacArthur's staff in Tokyo. In recent years he has been assigned as a division chief, Office Deputy Chief of Staff for Logistics, Department of the Army; Signal Adviser and Plans Chief for the MAAG, Germany; budget officer for the Third U.S. Army, Fort McPherson, Ga.; and deputy commander, 15th Support Brigade in Vietnam.

A graduate of the University of Maryland and a recipient of an MBA degree from Harvard University, he holds the Bronze Star for service in Vietnam, the Legion of Merit, Army Commendation Medal, and a Presidential Unit Citation.

Army Conducts Hawk Missile Exercise in Canal Zone

An Army Hawk missile exercise, using jet-powered aerial target systems as the simulated "enemy," was conducted in February in the Panama Canal Zone to sharpen skills of Hawk missilemen based there.

Hawk is a 17-foot-long supersonic missile that can destroy attacking high-performance aircraft or air-breathing guided missiles at low altitudes. The missile "homes in" on the target by following a reflected radar beam.

A mobile system in the Army's arsenal of air defense missile systems, Hawk is in operation with Army and Marine Corps units in the United States and overseas.

The missile exercise was staged at Pina Beach on the Atlantic side of the Canal Zone. Complete target units, including Firebees, launch and recovery equipment, plus related maintenance and field support equipment, were transported by air to the Canal Zone.

Launched into flight, the Firebees serve as vehicles for towing small-sized Towbee aerial targets at which the Hawk missiles are fired.

Army Hawk missile batteries are also conducting exercises through early spring at Okinawa. Additional on-site Hawk practice operations are also scheduled for Taiwan and other Pacific areas.

closely with AVLABS and The Surgeon General's Staff, used the ceramic tile composite to make chest protectors of a tolerable weight.

This material "defeated" hits by 7.62mm and .30-caliber armor-piercing (AP) projectiles. *For the first time in history, the concept of a body armor to stop rifle and machinegun bullets became a reality.* The new protectors were made available on a crash basis.

Lighter weight for torso armor was foreseen by AMC scientists and engineers if the ceramic material could be fashioned in one piece curved to fit the body. The ceramic industry at first said this was "impossible." Within a year, however, 2,000 form-fitting protectors were produced for experimental use in forward areas.

This significant state-of-the-art advance in ceramic manufacturing was accomplished by several producers almost simultaneously, using their funds to meet an urgent Army need.

Leg armor, primarily for crew chiefs and gunners, is now being evaluated in Vietnam but is not yet approved for type classification. The experimental armor has a curved thigh and lower leg unit covering the front and sides of the leg.

Since February 1965, three Army Materiel Command teams have visited Vietnam to study first-hand the problems related to armor systems. The first group of experts—representative of NLABS, BRL, AVLABS and the Army Aviation Materiel Command (AVCOM), St. Louis, Mo.—took several models of front, back and leg armor for trial evaluation.

Further evaluation was necessary for field acceptance and 500 sets of flat ceramic-fiber glass chest protectors were shipped to the team. Under the direction of an NLABS engineer, facilities in Vietnam were used to fabricate a suitable carrying system—a pocketed vest in which the chest piece would fit.

In mid-1965, procurement of protective HFC armor was ordered under an AMC contract with Aerojet General Corp., and tooling for anatomically curved, better-fitting armor was begun. Goodyear Corp., with the Norton Co. of Worcester, Mass., produced additional armor units during the latter part of 1965 and in January 1966.

A second team of armor specialists from HQ AMC, NLABS and AVCOM, including two from the first team, went to Vietnam in February 1966 for six weeks to continue the evaluation. Some 15 units and project officers in South Vietnam assisted in detailing armor requirements.

Concerned primarily with seat and groin armor for helicopter gunners, an NLABS combat clothing expert and an AMC HQ aerospace engineer took designs to Vietnam for consideration. Several thousand armor units produced by Reflective Laminants Co., Los Angeles, Calif., have been shipped to Vietnam, leading to better design as evaluation progresses.

Using the ausforming process, Philco Aeronutronic Division of the Ford Motor Co. developed a steel composite armor from which AVCOM engineers fabricated pilot seats.

Cooperative efforts of Army agencies and private industry provided a succession of ceramic armor materials. A lightweight silicon carbide composite was produced by the Carborundum Co. Brush Beryllium Corp. and the National Beryllia Corp. developed the beryllium oxide ceramic composite. Whittaker Corp. fabricated a silicon nitride ceramic composite armor.

Using a concept originated by the Army Materials and Mechanics Research Center (formerly the Army Materials Research Agency) at Watertown, Mass., the U.S. Steel Corp. developed a dual-hardness steel which could be processed with conventional heat-treating methods. Less expensive than the ausformed grade, it can be rolled, formed and welded quite easily.

Pilot and copilot seats for U.S. Army helicopters in Vietnam were armored as a result of this developmental program. Many aircraft now have protection for selected critical

(Continued on page 15)

UNIVERSITY OF FLORIDA LIBRARIES DOCUMENTS DEPT. APR 2 1968

GROUND ATTACK on a low-flying aircraft of the Army Concept Team in Vietnam (ACTIV) scored a hit through the *right* plexiglass windsheld of the UH-1D Huey helicopter (1) to strike the pilot, Col George A. Lutz (2). The round spalled and, with pieces of the experimental ceramic-faced armor vest (3), ricocheted across the cockpit through the *left* windshield and plexiglass door panel (4). Copilot Lt Col Richard Blanks, now with the U.S. Strike Command, McDill Air Force Base, Fla., lost his right eye from spall and received minor facial injuries. Col Lutz, who returned from Vietnam in June 1967, is military assistant to Leonard Sullivan, Deputy Director of Defense Research and Engineering (SEA Matters). The round struck him "like a sledge hammer" when the Huey was about 20 feet above the beach near Chu Lai, south of Da Nang, on a machinegun evaluation flight with the crew chief and door gunner when the unplanned test of aircrew torso armor occurred. Col Lutz reported to the Army Natick (Mass.) Laboratories that the incident "established the need for additional spall protection by reconfiguring edges of the armor."

Inter-American Defense College Educates Officers of 22 Nations

Thirteen Latin-American nations and the United States will be represented by the 35 military and civilian students of the Inter-American Defense College (IADC) at graduation ceremonies June 9, climaxing five years of stimulating success.

Since it was established in 1962 at historic Fort McNair, on the banks of the Potomac River in Washington, D.C., the IADC has achieved recognition as one of the world's prestigiously rated senior military institutions of higher education.

Instruction is patterned after the academic system of other senior service schools, such as the U.S. National War College, also located at Fort McNair; the Imperial Defence College of Great Britain, London; and the North American Treaty Organization (NATO) Defense College in Rome, Italy.

One of the strongest proponents for the establishment of the IADC, over a period of more than five years before it was founded, was the former U.S. Army Chief of Research and development, Lt Gen (USA, Ret.) Arthur G. Trudeau, president of Gulf Research and Development Corp.

In one respect, at least, the IADC faculty takes special pride when the institution is compared to the NATO Defense College—that is, it is representative of 22 member nations of the Organization of American States (OAS), in contrast to the 15 nations affiliated with NATO.

Based on the criteria for selection of students, the IADC can claim as high-calibered and as thoroughly integrated a group of military and civilian students as any international academic institution oriented to the problems of defense systems and relationships.

Presumably all of the 35 students now attending the IADC will graduate in June. In that event, the last student to receive a diploma will be the 227th graduate. That compares with somewhat more than 1,500 students graduated from the NATO Defense College since its 1951 founding.

MAIN BUILDING of Inter-American Defense College at Fort Lesley J. McNair.

Lt Gen James D. Alger
Chairman, IADB

Until its fifth class, when a 9-month curriculum was initiated, the IADC adhered to the NATO pattern of two "short" courses each academic year. The current class is IADC's seventh.

Parent organization of the IADC is the Inter-American Defense Board (IADB), representative of the 22 member nations of the OAS, with a chairman appointed by the President of the United States. Lt Gen James D. Alger, from 1964 to 1967 the CG of the U.S. Army Forces Southern Command, Panama Canal Zone, is the current chairman.

Each member nation may send up to five students to the IADC each year, provided they can meet the stringent selection criteria. Requirements include the rank of lieutenant colonel or above, or the equivalent as a government official; graduation from an advanced command and staff college or from an advanced-level college; military training and experience at an advanced level.

Most important, each nominee for the IADC student body must have the general qualifications to participate in solving problems related to defense of the Western Hemisphere, and must expect to remain on military or civilian duty in his country to use the knowledge acquired.

Each year the student body fluctuates in number according to the availability of senior personnel who can meet requirements and the problem of funding for some OAS nations.

Since its first day, the IADC has been multilingual as well as international. Classes are held in a 100-seat,

Maj Gen John B. Henry Jr., USAF
Director, IADC

Capt John H. Dinneen, USN
Chief of Administration, IADC

electronically equipped auditorium. At the right and left of the rostrum are glassed-in booths for interpreters (two men and two women) who "almost simultaneously" translate the speaker's words into English, Spanish, Portugese and French.

Translations are received through earphones with selective switches at each desk, similar to the system of communication at a small meeting of the United Nations. Haiti is the only French-speaking OAS member. Recent additions are Trinidad and Tobago and Barbados, West Indies Federation.

OAS members represented in the current class are Brazil, Chile, Argentina, Honduras, Bolivia, Venezuela, Ecuador, Dominican Republic, El Salvador, Paraguay, Colombia, Nicaragua, Mexico and the United States. Other member nations are Costa Rica, Guatemala, Haiti, Panama, Peru and Uruguay.

The college is devoted to courses on the Inter-American System and the political, social, economic and military factors that "constitute essential components of inter-American defense." The curriculum is designed to update and improve the education of those responsible for major undertakings requiring international cooperation.

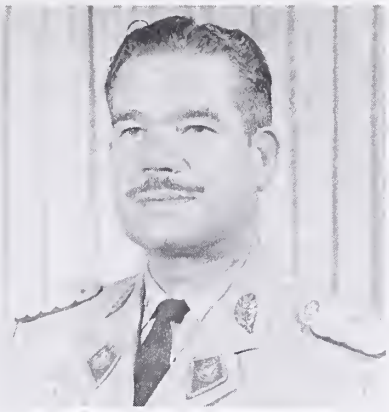
Progress is being made in building a library specializing in source material to support the curriculum. The library contains about 10,000 volumes and pamphlets in English, Spanish, Portugese and French. About 200 periodicals in the four basic languages used in the college are received regularly from various parts of the world.

Each class makes two 2-week tours during the academic year. The present class traveled in Uruguay, Peru, Honduras, Argentina and Mexico from Feb. 8 to 26 and next month will tour the United States.

Director of the IADC is Maj Gen John B. Henry Jr., who for three years was deputy inspector general at HQ U.S. Air Force in Washington, D.C., and then director, Secretary of the Air Force Personnel Council before his present assignment.

Current IADC deputy director is Venezuelan Army Brig Gen Martin Garcia Villasmil, whose strong academic background includes three years as director of the Venezuelan Military Academy. The chief of studies is Bolivian Army Brig Gen Emilio Molino Pizarro, former military attache to the Bolivian Embassy in Washington and Bolivian delegation chief to the IADB.

U.S. Navy Capt John H. Dinneen, former chief of the Internal Relations Division of the Office of Information, Navy Department, is the IADC chief of administration.



Brig Gen Martin Garcia Villasmil
Deputy Director, IADC

Brig Gen Emilio Molino Pizarro
Chief of Studies, IADC

Approximately $1 million furnished by the Military Assistance Program of the United States was used to rehabilitate and furnish the academic-administrative building, formerly a bachelor officers quarters and mess built 87 years ago and once used for Walter Reed Army Hospital.

In the opinion of the more than 200 carefully selected students who have benefited from IADC courses, no $1 million ever was used more effectively to promote international understanding, good will and integration of interests through advanced education.

Brig Gen Johnson Takes WECOM Post

Brig Gen Chester H. Johnson is the new deputy commander of the U.S. Army Weapons Command, following a tour of duty in the Netherlands as chief of the Army Section of the Military Assistance Advisory Group.

From September 1960 through May 1965, he served as Army Weapons Command director of Procurement and Production.

General Johnson's military career started in 1938 when he was commissioned in the Coast Artillery Corps, U.S. Army Reserve, following graduation from Kansas State University with a BS degree in civil engineering. From 1941 to 1946, he was at the Ordnance Research and Development Center, Aberdeen (Md.) Proving Ground, where he was involved in testing and development of ammunitions and weapons.

Brig Gen Chester H. Johnson

In January 1946, he returned to inactive Army Reserve status and resumed employment as an engineer in the Geophysical Department of the Mobile Oil Co. Integrated in 1947 into the Ordnance Corps, Regular Army, he was assigned to the Development and Proof Services, Aberdeen Proving Ground, until 1948.

After two years as an adviser to the Imperial Iranian Army, as a member of the U.S. Military Mission, he was assigned to the Industrial Division, Office of the Chief of Ordinance, Washington, D.C., until he attended the Command and General Staff College (1952–53).

Following graduation he served at the Small Arms Ammunition Center in St. Louis, Mo., and then was transferred to the Ammunition Center at Joliet, Ill., as deputy chief of the procurement Branch. In 1955, he started a 3-year tour as a procurement staff officer in the Office of the Assistant Secretary of the Army for Logistics.

After graduating from the Industrial College of the Armed Forces in 1959, he was assigned as chief of the Distribution Branch in the Supply Division of the G4 Section, HQ Eighth U.S. Army in Korea.

In September 1960, General Johnson was designated director, Procurement and Production Directorate at the U.S. Army Army Weapons Command at Rock Island Arsenal.

Arsenal Inspects Gun Barrels Ultrasonically

Ultrasonic sound is being used as a quality assurance tool at Rock Island (Ill.) Arsenal to determine internal cleanliness of steel used for gun barrels.

The automatic, computerized cleanliness inspection system was developed by International Harvester Manufacturing Research, aided by funds from the Army Materials Research Agency (recently redesignated the Army Materials and Mechanics Research Center), Watertown, Mass.

The ultrasonic sounding device is expected to save time and money on inspection of steel used in manufacturing critical and expensive materiel.

The technique was initiated by the arsenal largely through the efforts of Victor Vieths, a Rock Island metallurgist. Dissatisfied with the magnetic particle inspection method, the accepted standard for 20 years, he began investigating steel quality inspection criteria in 1960.

The new method is nondestructive and will examine approximately 85 percent of the total volume of gun barrel steel with greater accuracy in a much shorter time at less than half the cost of present methods. The magnetic particle method that has been used is time-consuming, destructive, (step-by-step machining of forgings is required), and has been applied to only about one percent of the total volume of gun-barrel steel.

While surveying metallurgical literature, Vieths learned of a new ultrasonic inspection system developed by International Harvester to assure the use of high-quality steel in its own production. He arranged to have several Rock Island Arsenal samples inspected with the system, and compared findings with results of his detailed magnetic particle tests.

After establishing a significant correlation, he felt further development was warranted. He submitted a project to AMRA, requesting funds for development of a similar system for Rock Island Arsenal.

The system teams a computer and an ultrasonic testing machine which uses sound waves to scan a bar of steel submerged in a tank of water. Nonmetallic inclusions within the steel reflect sound waves, which are converted into electrical energy, pictured on an oscilloscope, and instantly analyzed by the computer.

The computer counts every inclusion, categorizes it according to size, compares this information to acceptance limits stored in its memory banks, and releases the information to a teletype with the acceptance or rejection printed on paper.

Computer Prepares Metals Properties Tables

Computer preparation of data on the properties of metals in form ready for photo-offset printing reproduction is being demonstrated in the revision of Data Series Publication DS-7 of the American Society for Testing and Materials (ASTM).

The computer application to the tedious manual task of analyzing raw data and converting it into finished tables and graphs suitable for publication was accomplished by information specialists at the Columbus labs of Battelle Memorial Institute.

Revision of Data Series Publication DS–7 is being carried out for the Data and Publications Panel of the ASTM-ASME (American Society of Mechanical Engineers) Joint Committee on Effect of Temperature on the Properties of Metal.

The Defense Metals Information Center, operated by Battelle for the Department of Defense, is cosponsoring the project. The goal is to use the computer to the fullest extent in revision of "Report on the Elevated Temperature Properties of Selected Super-Strength Alloys."

Previously, engineers have had to analyze the data and plot the graphs, requiring draftsmen to prepare finished graphs and skilled typists to prepare finished tables. Battelle programs now enable the computer to perform most of the engineering "thinking" required to convert raw data into form for publication.

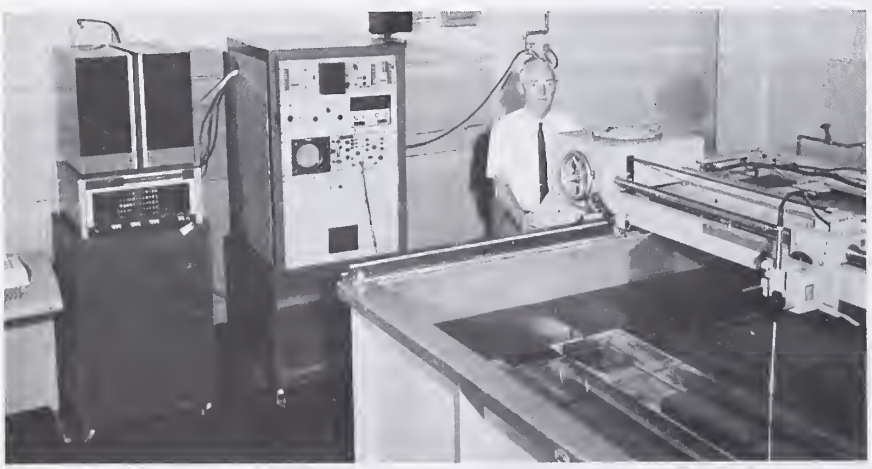
"Manual operations have been reduced to a fraction of that required previously, and except for the initial screening of data, the operations can now be conducted by personnel who have little or no engineering background," reported Donald P. Moon, project team leader at Battelle.

Data from reporting sheets and other sources are manually transcribed onto punched cards. The computer sorts the data by alloy, form and condition, identifies and extracts the facts pertinent to the task, interpolates or extrapolates data when necessary, rearranges that data for orderly presentation, and types finished tables in a form suitable for photographic reproduction.

In addition, the computer is programed to produce inked drawings of graphs from the data, and to fit the best curve to the points of the graph.

All that is required to make the computer output camera-ready copy is the addition of grid lines to the graphs and the drawing of boxes around the tables. This is done during final editing.

"With the computer programs written and proven out," stated Moon, "the task of analyzing data and preparing it for publication is relatively routine. This should lead to a substantial reduction in the time and cost of preparing engineering data for publication."



METALLURGIST Vic Vieths operates ultrasonic automated computerized cleanliness inspection system acquired for Rock Island (Ill.) Arsenal.

Army Awards $1,692,016 Contract For ABM Site Power Plant Design

The U.S. Army Corps of Engineres has awarded a $1,692,016 contract for design of power plants at Sentinel System antiballistic missile sites.

The plants will provide electricity for missile site radar, missile launchers and related facilities of the Sentinel System being constructed to protect this country against a possible attack by the Communist Chinese.

The contract was awarded to the Vernon Division of the Bechtel Corp., Los Angeles, Calif. Bechtel has been working with the Corps of Engineers on power plant development in association with the Army's antiballistic missile research and development.

The basic design developed under this contract will be adapted by other architect-engineer firms for power plant facilities at the follow-on sites.

Mosquitoes Prefer VC Tunnels to Swamps as Dry Weather Retreat

Mosquitoes in Vietnam's famed "Iron Triangle" are taking a cue from the Viet Cong and are finding the tunnels favorable to survival, much more so in dry weather than the surrounding jungle and swamps, an Army research scientist reports.

Lt Col Alvin R. Hylton, who made his observations while assigned to the U.S. Army 1st Infantry Division in Vietnam, is now stationed at the Infantry School, Fort Benning, Ga. His scientific report is titled "Mansonia Uniformis Mosquitoes in Viet Cong Tunnels."

On one occasion, samples of mosquitoes were collected from a 300-foot stretch of tunnel six feet underground in the Iron Triangle. Of 42 female mosquitoes identified, 39 were *Mansonia uniformis*, and the remaining three could not be identified. Field identifications of the mosquitoes were confirmed by the 20th Preventive Medical Unit, Saigon, RVN.

At the time of collection, tunnel temperatures were recorded and relative humidities were determined with a Bendix Psychometer, Model 566. Temperatures and relative humidities within the tunnel are given in Table 1. For comparison, the data for the surrounding jungle are given in Table 2.

The Iron Triangle jungle consists primarily of indigenous hardwoods which constitute the initial canopy. A secondary canopy is formed by tall shrubs, bamboo and trees similar to scrub pines.

During the 2-week period prior to exploration of the area, only .07 inches of precipitation had been recorded; hence, no ground pools or other water sources were found in the immediate vicinity of the tunnel. The Saigon River, however, with its bordering rice paddies, was within 1,000 meters of the area.

Within the tunnel, the humidty was very high (see Table 2), and although no pools of water were found, the tunnel floor was muddy in places and the walls were damp.

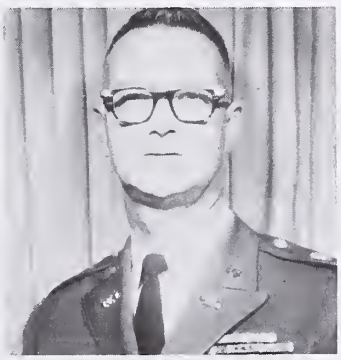
Pottery jars containing water or other liquids were found throughout the tunnel complex, It was apparent that blood meals for the insects were obtained from the Viet Cong, who had recently occupied the tunnels, and from the rodents and bats that flourished there.

Whether the adult mosquitoes were attracted to the tunnel because of favorable resting conditions, or because of the presence of a blood source, or a combination of both, was not determined.

The observations did point out, however, that although mosquitoes normally seek dry-season shelters on the forest floor, where suitable conditions occur, the *Mansonia uniformis* will readily inhabit a subterranean shelter with a proper microclimate.

Lt Col Hylton served with the Life Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development (1965–66) after completing the Command and General Staff College. He holds a BS degree from Iowa State University and ScD degree from the Johns Hopkins University, Baltimore, Md.

Among his military awards are the Legion of Merit, Distinguished Flying Cross, Bronze Star Medal, Air Medal with four Oak Leaf Clusters, Commendation Medal with two Oak Leaf Clusters, and the RVN Cross of Gallantry with Silver Star.



Lt Col Alvin R. Hylton

Table 1
Tunnel Temperatures and Relative Humidities

Location	*Temp. °F.*	*%R.H.*	*Temp. °F.*	*%R.H.*	*Temp. °F.*	*%R.H.*
Tunnel entrance	77	85.5	77	86	77.5	86
60 feet	79	92	79.5	92	79.5	93
130 feet	81	98	81	97	81	97
200 feet	80	100	80	100	80	100
300 feet	80	100	80.5	99.5	80.5	99.5
Tunnel exit	84	82	85	82	85	81

Table 2
Micrometeorological Data for the An Son Area (the Iron Triangle)*

		Average Temp. °F.			*Average Percent R.H.*		
Average Rainfall (in.)		*min.*	*mean*	*max.*	*min.*	*mean*	*max.*
Average annual	70	74	85	89	64	79	93
Average wet season **	60	75	83	88	72	84	95
Average dry season ***	10	69	86	94	56	73	90

* These data courtesy of the USAF Sir Weather Station, Phu Loi, RVN.
** May through October.
*** November through April.

USACDC Holds Seminar On Low-Intensity Conflict

Problems of low-intensity conflict pertaining to the roles of military leaders, civil affairs officers, police and those engaged in medical service and psychological operations were discussed recently at a Stability Operations Seminar.

Held at Fort Belvoir, Va., the meeting was sponsored by the Doctrine Directorate, the U.S. Army Combat Developments Command (USACDC).

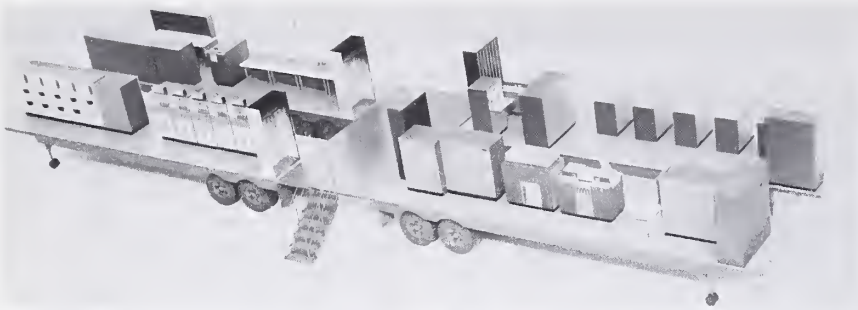
Lt Gen Harry W. O. Kinnard, CG of the USACDC, introduced Maj Gen William P. Yarborough, Army Assistant Chief of Staff for Intelligence, as a featured speaker.

Major Gen Leonard C. Shea, director for International and Civil Affairs, Office of the Deputy Chief of Staff for Operations, headed a group of officers who discussed analysis and development of U.S. counterinsurgency doctrine and organization. Discussion focused on a systems approach to stability operations doctrine.

The seminar was attended by commanding officers or representatives of the USACDC Special Warfare Agency at Fort Bragg, N.C.; Combined Arms Group at Fort Leavenworth, Kans.; Army Intelligence Agency at Fort Holabird, Md.; Medical Service Agency at Fort Sam Houston, Tex.; USACDC Military Police Agency at Fort Gordon, Ga.; USACDC Chaplain Agency at Fort Lee, Va.; Office of the Assistant Chief of Staff for Force Development and other General Staff agencies.

ECOM Physicist Elected APS Fellow

Physicist Herbert L. Mette of the Army Electronics Command's Electronic Components Laboratory has been elected a Fellow of the American Physical Society. The author of more than 30 papers on semiconductor physics and devices, he is chief of the Integrated Device Techniques Branch of the laboratory's Integrated Electronics Division.



COMBAT SERVICE SUPPORT SYSTEM equipment installed in 35-foot trailer vans with air cushions for travel over rough roads. Models (clockwise from left) show installations for maintenance and support; data communications; System/360 Model 40 central processor, and mass data storage facilities.

Combat Service Support System Tests Set for May

Combat Service Support System (CS3) Phase II Acceptance Tests will begin in May, following a preliminary check-out of the Army's data processing and communications system for field use at Fort Hood, Tex.

When fully operational, CS3 will be part of a larger program known as ADSAF (Automatic Data Systems within the Army in the Field) and will be highly mobile as well as air-transportable. Each CS3 installation has four 35-foot trailer-vans, one for each of the following:

- IBM System/360 Model 40 central processor.
- IBM 2314 direct-access storage with 233.4 million characters (bytes) of information stored in eight revolving magnetic disks. System/360 can retrieve information from the disks at 312,000 characters a second.
- Equipment for transmitting and receiving digital data by wire or radio.
- Maintenance and support equipment, including devices for recording information on punched cards.

Remote substations with equipment for communicating with the vans will be in portable shelters on trucks.

CS3 is one of three major command and control information systems under development by the Army Automatic Data Field Systems Command (ADFSC), headquartered at Fort Belvoir, Va., and commanded by Brig Gen Wilson R. Reed. ADFSC is a subordinate command of the U.S. Army Combat Developments Command.

General Reed is also the ADSAF project manager, in which capacity he represents the developer and supplier of the systems; as commander of ADFSC, he represents the user.

The other two systems are the Tactical Fire Direction System (TACFIRE), and the Tactical Operations System (TOS). (See September 1966 edition of this Newsmagazine for first anniversary feature on ADFSC data processing systems; April 1967 edition for TACFIRE, and September 1967 edition for TOS field units in Germany.)

TACFIRE is designed to increase effectiveness of fire support through improved accuracy and more rapid use of target information. It will automate selected artillery functions, such as ammunition and fire unit status, fire planning, target intelligence, tactical and technical fire control, artillery survey and meteorological data.

The TOS will assist in certain functions of operations, intelligence and fire support coordination. Areas include friendly unit status, task, organization, road networks, tactical troop movement, barrier planning, radio frequency allocation and engineer tactical operations.

Through integrated automation, the CS3 is part of a computer-supported personnel and administration system, and a logistics support system for the Army in the field during the 1970–75 time frame.

The combat service support functions basically include activities supervised by the G-1 (Personnel), G–4 (Logistics), G–5 (Civil Affairs), and Comptroller, for any given echelon.

The ultimate goal of CS3 is to integrate selected functions of the G-1, G-4, G-5, and Comptroller into an ADP system. The goal is to reduce the administrative burden on troop units as well as improve the effectiveness of military support activities.

CS3 will provide combat service support unit commanders with data leading to operational decisions based on the best utilization of available resources; tactical commanders and their staffs with current, accurate information on the combat service support situation; and HQ Department of the Army agencies with information required for their missions.

The CS3 Directorate at Fort Belvoir is headed by Lt Col George R Fullerton. The command has established a CS3 Assistance Group at Karlsruhe, Germany; a CS3 Test Group at Fort Hood, Tex.; and a CS3 Agency at Fort Lee, Va.

Long-range plans call for worldwide use that would place CS3 systems in all divisions, support brigades, field army support commands and theater army support activities. Additional functions will be designed and added to the CS3 system as required to provide the combat commander with full-range automated combat service support.

TECOM Assigns New Chief of N-B-C Testing

Nuclear, biological and chemical testing at HQ U.S. Army Test and Evaluation Command, Aberdeen (Md.) Proving Ground, is now under the direction of Lt Col Louis O. Elsaesser.

Col James R. Chapman had served in that capacity since June 1965 and recently was assigned as special assistant to the TECOM chief of staff.

Col Elsaesser recently returned from Vietnam, where he was deputy chief of staff, Plans and Operations, U.S. Army. He is a 1946 graduate from the U.S. Military Academy, where he has served six years as an associate professor of chemistry. In 1953 he was graduated from Ohio State University with an MS degree in chemical engineering.

From 1962 to 1964, he was assigned to the Office of the Director of Defense Research and Engineering, after which he served his second tour at the USMA as an instructor.

Following service with the 7th Infantry Division in Korea (1959–60), he attended the Command and General Staff College, graduating in June 1961. He then served a year in the Office of the Army Chief Chemical Officer.

Lt Col L. O. Elsaesser

OCRD Announces Assignment of 2 Officers

Col Robert A Smith is the new chief of the Technical and Industrial Liaison Office, Office of the Chief of Research and Development.

Returned recently from Vietnam, where he was senior military adviser to Quang Tri Province, Col Smith received two of the highest awards of the government of the Republic of Vietnam—the Cross of Gallantry with Gold Star and the Medal of Honor—plus the U.S. Legion of Merit.

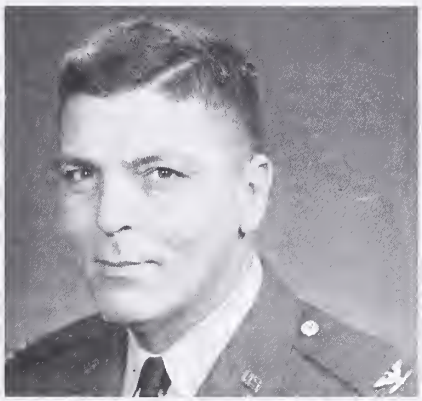
Other assignments have included: Assistant DCSLOG, HQ U.S. Military Academy (1964–66); commanding officer, 1st Battle Group, 1st Infantry, USMA (1962–64); and duty with the Combat Developments Section, HQ U.S. Continental Army Command (1960–62).

Col Smith graduated from the United States Military Academy in 1944 and has attended the Command and General Staff College.

LT COL W. E. DISMORE Jr. was recently assigned to the OCRD Nuclear-Chemical-Biological Divison, following graduation from the Armed Forces Staff College.

From 1966 to 1967, he was an R&D coordinator in the Weapons Development and Engineering Laboratories, Edgewood Arsenal, Md., following assignment as chemical officer, 1st Infantry Division, Fort Riley, Kans., and in Vietnam, 1964 to 1966. For three years previously, he taught military science at the University of California at Los Angeles.

Lt Col Dismore received a BS degree in bacteriology from Purdue University in 1952. His awards include the Legion of Merit, Distinguished Flying Cross and Bronze Star.



Col Robert A. Smith

Lt Col W. E. Dismore Jr.

Program Seeks to Improve Higher Education in Math

Under cosponsorship of the Mathematical Association of America and the National Science Foundation, a program to expand and improve mathematics education in universities, colleges and junior colleges throughout the U.S. began Feb. 1.

Prof. Ralph P. Boas, chairman of the Northwestern University Department of Mathematics, has been selected for a 3-year term as chairman of the Committee on the Undergraduate Program in Mathematics.

This project is one of eight curricular improvement programs cosponsored by the National Science Foundation and various scientific professional organizations.

The Mathematical Association of America has, in the past, recommended new mathematics study programs for biologists, elementary school teachers, engineers, physical scientists, and mathematicians.

The committee headed by Prof. Boas will also be concerned with the type of graduate instruction needed by college mathematics teachers, and with the mathematics requirements for training in use of computers as well as the proper undergraduate program in statistics.

Chairman of the Northwestern University Department of Mathematics since 1957, Prof. Boas has been successful in stimulating interest to the degree that the number of undergraduates taking math courses has increased from less than 1,000 to more than 2,500. Total undergraduate enrollment at Northwestern has remained between 5,000 and 6,400 the past decade.

Significant also is the fact that the number of mathematics majors at Northwestern this year is about 120—almost double the number during the past academic year.

Since receiving his doctorate in mathematics from Harvard University in 1937, Prof. Boas has served as a lecturer there and at Massachusetts Institute of Technology, and as an instructor at Duke University.

Prescott Becomes AACOMS Project Manager

Col Dana S. Prescott has been assigned to head the Project Management Office for the Army Area Communications System (AACOMS), responsible for developing improved multichannel communications for the field army.

The project office at Fort Monmouth, N.J., reports through the Army Electronics Command to the CG of the Army Materiel Command.

Col Prescott recently completed a tour as chief of the Advisory Division, Office of the Assistant Chief of Staff for Communications-Electronics, Military Assistance Command Vietnam, a position now filled by Col James M. Templeman, who preceded him at AACOMS

Col Dana S. Prescott

Col Prescott has served in a wide range of combat and general assignments, including duty as a teacher at universities and service schools.

He graduated from Dartmouth College in 1937 with a BA degree, from Harvard Graduate School of Business Administration in 1939 with a master's degree, and from George Washington University in 1966 with a master's in international affairs.

In 1954 he attended the Army Command and General Staff College and returned there in 1958 to serve four years on the staff and faculty. He was graduated from the Naval War College in 1966 and recently completed the Defense Weapons Management course at Wright-Patterson Air Force Base, Ohio.

His decorations include the Legion of Merit, Army Commendation Medal, Distinguished Service Order of Vietnam, and the Iranian Order of Merit.

3 Young Americans Score at Japan Science Awards

Resolution and results were purposefully and effectively blended by three outstanding young Americans who represented the Army, Navy and Air Force at the 11th Japan Student Science Awards in Tokyo.

Prime objectives of participation in the biggest annual event in Japan for young scientists are to reflect the standard of scientific achievement in American high schools, and to serve as ambassadors of good will to the Japanese people.

In both respects, this year's representatives scored impressively. Their exhibits of research experiments earned general acclamation from Japanese students and adults. Much more notable, however, was the warm responsiveness they engendered in numerous public appearances and in visits to Japanese homes.

The Japan Student Science Awards are sponsored by the *Yomiuri Shimbun*, one of Japan's largest newspapers. It also sponsors each year the participation of selected Japanese science students in the International Science Fair, held in the United States under auspices of Science Service.

Five years ago, the U.S. Army, Navy and Air Force initiated the policy of selecting three outstanding boys or girls from among the winners in the International Science Fair (ISF) to go to the Japan Student Science Awards.

The Army representative this year was Scott A. Jenkins, an exuberant 17-year-old envoy whose outgoing personality made him a center of attraction.

Janice Moos, representing the U.S. Navy, and Robert A Warriner III, the scholarly looking Air Force choice, each contributed qualities of personality that won manifestations of affection from Japanese audiences wherever they appeared.

Scott Jenkins poses with Japanese maidens in Otani Hotel gardens.

Only once during their 8-day stay in Japan was the enthusiastic ebullience of Scott Jenkins for everything that he saw and did rather effectively, if only briefly, tempered.

When visiting in a Japanese home, he was somewhat nonplussed when one of the first acts of his hosts was to escort him to a bedroom, divest him of his outer garments, and attire him in a colorful kimono.

Escorted during their visit by Howard Weisbrod acting coordinator for Science Service, and Capt Peter L. Sloan, Office of Information, HQ U.S. Air Force, the American students were welcomed by Col Charles W. Cook, commander, U.S. Army Research and Development Group, Far East.

Japan's Prince and Princess Hitachi joined with Nobel Prize science winner Shinichiro Tomonaga and a number of top Japanese government officials as participants in the impressive awards ceremonies at the Tokyo Science Museum, where the students displayed research exhibits.

During their rigorous itinerary, scheduled to permit them to cram as much activity as possible into eight days, the American students visited Japanese educational institutions, industrial facilities, the U.S. Embassy, where they were received by Ambassador U. Alexis Johnson, and the Imperial Palace.

Jenkins is a senior at Valley High School, Albuquerque, N. Mex., and is concurrently taking evening courses at the University of New Mexico.

Each year since 1965, he has taken first place in the New Mexico State Science Fairs. He also was a New Mexico representative in the 17th and 18th International Science Fairs.

Selected among the top 13 young scientists in the 17th ISF, he also received special awards from the U.S. Air Force and American Institute of Chemical Engineers. In the 18th ISF he received awards from the National Aeronautics and Space Agency.

Recipient of the Dr. John D. Clark Award in Science in 1966 and 1967, sponsored by the University of New Mexico, he also participated during the summer of 1967 in the National Science Foundation program at Scripps Institute of Oceanography, La Jolla, Calif.

The ISF prize-winning research result he exhibited in Japan was titled "Development of a Neutral Boundary Layer Disturbance Theory for Drag Reduction by Acoustical Interaction." The first aim of the experiment was to determine the causes of the drag (resistance) exerted on flat plates in an air flow; the second, to determine how drag on flat plates can be reduced.

U.S. DELEGATES to recent 11th Japan Students Science Awards are (l. to r.) Robert Warringer, Air Force; Janice Moos, Navy; and Scott Jenkins, Army.

Jenkins admits that he has received "considerable encouragement and help" from both parents for his research experimentation. He anticipates attending Princeton, Harvard or Yale University if accepted.

Aircraft Models Deferred For Higher DoD Priorities

Fabrication of three Army composite research aircraft, as contemplated nearly a year ago, has been deferred in view of higher priority Department of Defense needs.

The composite models, an Army spokesman said, would have permitted early flight testing of advanced rotor concepts expected to improve significantly the speed and performance of rotor-wing aircraft.

Investigation of promising advanced rotor concepts will continue despite the decision to postpone construction of the three preprototypes. Both "tilting rotor" and "retracted rotor" designs were subjected to a detailed analysis by a Source Selection Advisory Council when deferral action was taken.

WECOM Gets New Grenade Launcher

First deliveries of the new XM-129 high-rate-of-fire grenade launcher for Army helicopters have been announced by the U.S. Army Weapons Command, Army Materiel Command agency at Rock Island Arsenal, Ill.

Capable of firing a 40mm high-explosive high-velocity round at rates up to 450 shots per minute, the launcher will be used in the main armament systems of the Huey UH-1C, AH-1G Huey Cobra and Cayuse helicopters. It will replace the M75 now used in Vietnam.

Composite Torso Armor Classified 'Standard A'

(*Continued from page 7*)

components. The newer gunships and transports—Huey Cobra, Cheyenne and the Ch–47—have built-in protection for almost all critical parts.

Armored seats have been developed for the UH–1, CH–47, OH–6 and AH–1G, and armor seat protection has been provided for the H–13, H–23 and O–1. Additionally, armor protection for the critical components of the UH–1, CH–47, CH–54, OH–6, AH–1G and OV–1 has been developed and is in use in Vietnam on all of these aircraft except the UH–1.

AVLABS investigators are initiating the manufacture of some critical aircraft components from armor materials. This advance would minimize the placement of armor *around* the components. Under consideration are gear-box housings, actuator cylinders, engine compressor housings and oil sumps.

NLABS scientists have designed an experimental ceramic composite armor vest as protection for foot soldiers against small-arms fire which is being produced under contract. Rapid materials developments hold promise for the first time of providing bullet-proof protection without the weight burden of materials tested in the Korean War.

Army agencies are coordinating efforts in development as follows:

Natick (Mass.) Laboratories have prime responsibility for protective combat clothing and related materials research, design, prototype fabrication, testing and procurement of body armor to meet requirements.

Army Materials and Mechanics Research Center, Watertown, Mass., and *Frankford Arsenal*, Philadelphia, Pa., are responsible for materials research.

Army Development and Proof Services and *Ballistic Research Laboratories*, both at Aberdeen Proving Ground, Md., conduct ballistic tests and provide vulnerability data.

Army Chemical Research and Development Laboratories, Edgewood, Md., conduct wound assessment tests.

Office of The Surgeon General Washington, D.C., provides medical support in priority areas of protection, and casualty data.

Picatinny Arsenal, Dover, N.J., provides technical assistance in developing production techniques, bonding ceramics to fiber glass, fiber glass requirements and ballistic confirmation tests.

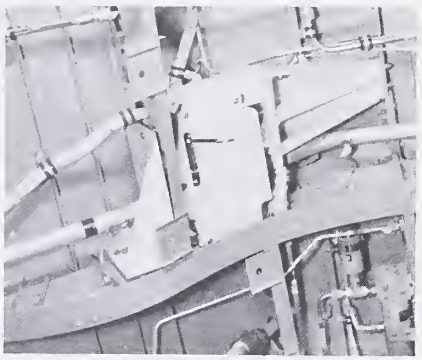
Army Aviation Materiel Command and *Army Aviation Materiel Laboratories* are responsible for designing, developing and procuring aircraft armor in coordination with NLABS to assure compatibility of systems with aircraft weight limitations.

Participating industries not mentioned earlier in this article include Coors Porcelain Co., Golden, Colo.; Uniroyal (U.S. Rubber Co.), Meshowako, Ind.; Frenchtown/CFI, Inc., Frenchtown, N.J.; and Union Carbide Corp., New York, N.Y.

Army laboratories, working closely with American industry, are continuing efforts to improve armor for both personnel and aircraft for protection against enemy ground fire.

The search for efficient transparent materials for face and head protection has led scientists to special glasses and plastics.

Even semiprecious stones, such as the emerald, are under experimentation. They provide curious objects d'art in laboratories where researchers continue their pursuit of the ultimate in man and aircraft armor.



COMPOSITE steel armor protects vulnerable fuel valve aboard Army 'copter.

ROA Dedicates New Headquarters Building

The Minute Man Memorial Building, $1.5 million 5-story limestone structure at 1 Constitution Ave., N.E., Washington, D.C., was dedicated on George Washington's birthday as National Headquarters, Reserve Officers Association (ROA).

Naval Reserve Capt Vincent A. Primerano, New York City attorney and national president of ROA, said that since 1960 more than 30,000 individuals contributed an average of $40 each to the Building Fund. ROA has about 55,000 members representing all of the U.S. military Reserve components.

Speakers at the dedication included Senator John C. Stennis, chairman of the Senate Preparedness Subcommittee; Representatives Mendel Rivers, chairman of the House Armed Services Committee, and Bob Sikes, a senior member of the Defense Appropriations Committee.

Selective Service Director Lt Gen Lewis B. Hershey (USA, Ret.), chairman of the building fund campaign during 1960–64 when most of the contributions were made, also spoke briefly, commending those who made this building possible.

ROA Headquarters

Highlight of the morning ceremonies was the unveiling of an exact replica of the Daniel Chester French statue of the Revolutionary War Minute Man which stands at the historic bridge on the outskirts of Concord, Mass. The statue dominates the first floor, known as Minute Man Memorial Hall.

ROA executive director Col John T. Carlton, USAR, was in charge of the dedication program and transfer of the headquarters operations.

The 22-member staff will occupy the 2d, 3d and 4th floors. The 5th floor is a large reception hall named by the association the Congressional Hall of Honor as a tribute to the members of Congress, beginning with George Washington.

On the 2d floor is the ROA Ladies National Suite and there is a "VIP" suite, the John J. Pershing Memorial Suite, honoring the memory of the World War I military leader who helped ROA ogranize in the early 1920s.

On the building's 4th floor is a military library named for the late Army Reserve Brig Gen Henry J. Reilly, ROA's first national president, a major contributor to the building fund who also bequeathed his library of some 6,000 books.

CSC Sets Up Training Centers

The Civil Service Commission is setting up regional training centers in Atlanta, Boston, Chicago, Dallas, Denver, New York, Philadelphia, St. Louis, Seattle and San Francisco to provide federal employes with specialized training in government work.

Major activities will include training in personnel management, welfare management, general manager, communications and office skills and financial management. Training conducted by the CSC's regional offices in the past will be absorbed by the new centers.

RDT&E, Procurement Contracts Exceed $491 Million

Army research, development, testing and evaluation, and procurement contracts exceeding $1 million each for the period Jan. 12 to Feb. 11 totaled $491,719,615.

Kaiser Jeep Corp, accounted for nearly a third of the total with a contract to furnish 2½-ton trucks for $117,898,298. Hercules Engines, Inc., won the second highest contract of $34,192,681 for multifuel engines, trucks and repair parts.

Remington Arms Co. received a $28,229,878 contract modification for small arms ammunition. A modification for $26,021,327 issued to National Presto Industries, Inc., is for 105mm projectile parts.

Four contracts totaling $24,406,326 awarded to Raytheon Co. call for advanced development of the SAM–D missile system and advanced production engineering services for the Hawk missile system.

A $19,911,626 contract for 81mm projectiles and 105mm cartridge cases went to Norris Industries. General Motors received contracts totaling $19,306,623 for trucks, howitzers, rebuilding transmissions and other repair services. Atlas Corp. and H. C. Smith Construction Co. won a joint contract of $14,137,000 for logistic support of the Kwajalein Test Site in the Marshall Islands.

Chamberlain Manufacturing Corp. received contracts totaling $13,132,825 for cartridge cases, metal parts for 81mm mortars and 105mm projectiles. Texas Instruments, Inc., was awarded contracts totaling $11,700,000 for night-vision aerial surveillance systems and electronic equipment.

Metal parts and fin assemblies for 750-pound bombs will be supplied by R. G. LeTourneau, Inc., for $10,391,948. American Machine and Foundry Co. will provide metal parts for 750-pound bombs for $9,921,576.

Illuminating projectiles and miscellaneous propellants will be furnished by the Olin Mathieson Chemical Corp. for $8,524,695. General Electric Co. received contracts totaling $6,685,718 for Cheyenne aircraft engines and 20mm automatic guns.

Page Communication Engineering, Inc., gained a $6,027,923 modification for engineering, installation, operation and maintenance, and expansion of the integrated wide-band communication system in Vietnam. Chrysler Motor Corp. will provide trucks for $6,565,413.

Northrop Corp. will supply projectiles for $6,005,784. Philco-Ford Corp. received contracts totaling $5,922,242 for R&D on the Chaparral missile system and for Phase III augmentation and spares for the IWCS. Magnavox was awarded a $5,917,685 contract for artillery gun computers.

Ralph M. Parsons Co. will provide architectural engineering services for design of the Sentinel system antiballistic missile radar and launch facilities for $4,904,174. Delaware Valley Armaments, Inc., was issued a $4,611,600 modification for metal parts for artillery shell fuze boosters. Bogue Electric Manufacturing Co. received a $4,609,017 modification for generator sets.

AVCO Corp. was issued modifications totaling $4,597,515 for ground-support equipment and special tools in support of Chinook engines, production facilities and spare parts for UH–1 helicopter engines, and a product support and component improvement program for T53 series engines.

Rulon Co. will furnish metal parts for 105mm cartridges for $4,353,501. A $4,309,831 modification to Lear Siegler, Inc., is for metal parts for 105mm cartridge fuzes. Bethlehem Steel Corp. won a $4,000,000 contract for tube forgings for 175mm guns.

DeLong Corp. was issued a $3,779,000 modification for piers in Southeast Asia, Cessna Aircraft Co., $3,668,000, for bomb dispensers and Hamilton Watch Co., $3,661,823, for safety and arming devices for artillery fuzes.

Motor tubes for 2.75-inch rockets will be supplied by the Aluminum Co. of America for $3,616,499 and Bulova Watch Co. will furnish head assemblies for 60mm fuzes for $3,299,186. A $3,080,000 contract awarded to Bermite Powder Co. is for loading, assembling and packing point detonating fuzes for 20mm cartridges.

United Aircraft Corp. received a $3,075,000 modification for CH–54A aircraft engines. Gould National Batteries, Inc., won a $3,047,030 contract for a M514 fuze component and John Wood Co. will supply 750-pound bomb fin assemblies for $3,006,848.

Honeywell, Inc., will provide fuzes and electronic equipment for $2,992,835, Wagner Electric Corp. metal parts for 4.2-inch projectiles for $2,912,760, and AMETEK Corp. support assemblies for 105mm cartridge containers for $2,688,720.

Columbus Milpar Manufacturing Co. received a $2,596,000 contract for metal parts for 81mm cartridge fuzes, Western Electric Co. a $2,512,270 modification for hard site defense studies for the Sentinel System, and Teletype Corp. a $2,500,000 contract for electronic equipment.

Dry batteries procured from P. R. Mallory and Co., Inc., will cost $2,385,694 and LTV Electrosystems, Inc., will furnish AN/PRC–25 radio sets for $2,271,120. Time fuzes for artillery and illuminating shells will be purchased from General Time Corp. for $2,267,878. Grand Machining Co. will supply 81mm mortar fin assemblies for $2,029,800.

Other contracts and modifications included:

Kennedy Van Saun Corp., $1,947,020 for metal parts for 105mm projectiles; Sylvania Electric Products, Inc., $1,772,862 for radio sets, direction finders and controlled communication sets; Beech Aircraft Corp., $1,668,000 for bomb dispensers; Mohawk Rubber Co., $1,650,602 for tires; Alcan Aluminum Corp., $1,629,540 for parts for 66mm rocket motors; and

Baldwin Electronics, Inc., $1,609,601 for loading, assembling and packing 2.75-inch rocket motors; Lockheed Aircraft Corp., $1,600,000 for design and development of the military version of the 6-wheel articulated vehicle; Hughes Aircraft Co., $1,396,000 for advanced production engineering for the XM26 armament subsystem and TOW missiles for UH–1 helicopters; and

Harvard Industries, Inc., $1,392,066 for shelters for electric equipment; Nu-Pak Co., $1,378,837 for rotor blade shipping and storage containers for the Iroquois helicopter; Wells Marine Corp., $1,346,030 for metal parts for 20mm target-practice projectiles; Bell Aerospace Corp., $1,249,750 for UH–1 helicopter main rotor hub assemblies; and

Varo, Inc., $1,242,700 for searchlights; Martin Marietta Corp., $1,225,000 for industrial engineering services in support of the Pershing weapon system; Southwest Truck Body Co., Inc., $1,214,488 for semi-trailer-mounted electronic repair shop equipment; Litton Systems, Inc., $1,213,401 for a complete self-contained communications facility; and

Ingersoll-Rand, $1,172,324 for pneumatic tool outfits; American Fabricated Products, Inc., $1,130,963 for fin assemblies for 81mm mortars; International Harvester Co., $1,106,332 for trucks; Polan Industries, Inc., $1,046,719 for infrared optical periscopes and spare heads; Cummins Engine Co., $1,043,174 for diesel engines for 10-ton trucks; and Kisco Co., $1,008,537 for shipping containers for 20mm shells.

ASAP Studying Reduction of Lead Time

A fresh look at an old Army R&D problem of continuing major concern, that of reducing lead time between a creative concept for materiel and its fruition as an item for field troops, is being taken by an ad hoc group of the Army Scientific Advisory Panel (ASAP).

Chairman of the 10-member group is Herbert K. Weiss, manager of the Analysis Department of Litton Industries. When the group met recently at HQ U.S. Army Combat Developments Command, he had a dual role since he is also a key member of the USACDC Scientific Advisory Group.

Functions of the two groups are parallel to the extent that each is concerned with the important problem of "coupling," that is, rapidly providing to designers of Army materiel the latest information on basic or exploratory research results that may shorten lead time.

This was the theme of the 1966 Army Science Conference, "Basic Research and Practical Relevancy."

Since the USACDC prides itself as being the Army's "Idea Shop" for the development of visionary concepts for dramatic advances in new weaponry and tactical doctrine, the meeting of the ASAP ad hoc group at Fort Belvoir, Va., engendered thought-provoking discussion.

Other ad hoc group members are Dr. Ali B. Cambel, vice president, Institute for Defense Analysis; Dean Morrough P. O'Brien, former chairman of ASAP and dean emeritus, College of Engineering, University of California at Berkeley; Dr. Richard C. Raymond, Consultant-Information Sciences, Research and Development Center, General Electric Co.; Dr. Bruce A. Reese, director, Jet Propulsion Center and professor of mechanical engineering, Purdue University; Stanley W. Burriss, vice president and general manager, Missile Systems Division, Lockheed Missiles and Space Co.; James N. Davis, vice president, Booz-Allen Applied Research, Inc., John B. Jackson, vice president, IBM Corp.; Dr. William H. Martin, consultant and former Army Director of R&D.

Dean O'Brien and Drs. Cambel and Martin are also members of the USACDC Scientific Advisory Group. Lt Col Merle F. Ormond, chief of the Policy Branch, Office of the Chief of Research and Development, is military staff assistant.

ECOM Research Range Shown By 1967 Total of 630 Papers

Depth and variety of basic research at the U.S. Army Electronics Command was reflected in 1967 by the presentation and publication of 630 unclassified technical papers.

In making this report, ECOM Deputy for Science and Chief Scientist Dr. Hans K. Ziegler commented that the total represented an appreciable gain over the previous year, despite the tremendous increase in workload imposed by the war in Southeast Asia.

The papers were presented at professional conferences or published in leading journals in the United States, Italy, France, England, Turkey, West Germany and numerous other countries.

Dr. Ziegler explained that 352 of the papers were prepared by ECOM in-house personnel and 278 by scientists and engineers of industrial firms, universities and institutes doing contract research for the Army. A letter from a leading U.S. electronic firm stated:

"Your foresight in sponsoring advanced developed efforts, as well as your encouragement of accurate reporting and publishing, does not go unappreciated in industrial labs."

Scoop Loader Modified to Rough-Terrain Forklift Truck

Off-road materials-handling equipment (MHE), a rapidly growing Army family since the MR100 rough-terrain telefork developed in the mid-1950s gave a big lift to military logistics, has a powerful addition to meet an urgent requirement.

Being tested to determine its suitability for issue to troop units is a standard scoop loader modified for operation as a rough-terrain forklift truck. Because of its potential application to logistics problems in Southeast Asia, the vehicle is being subjected to around-the-clock, 7-day-week tests.

The General Equipment Test Activity (GETA) at Fort Lee, Va., is conducting the tests on the modified diesel-engine-driven 10,500-pound capacity loader. Equipped with a new 78-inch forklift attachment, it has performed well in lifting and transporting CONEX containers and palletized and nonpalletized materials.

An engineering team representing three of GETA's five test operating directorates is engaged in the initial production tests at Forts Lee and Story, Va., to determine suitability of the vehicle for service in and around supply dumps and field depots in a combat theater.

CONVERTED SCOOP LOADER, with a simulated 10,500-pound payload.

Specially designed rough-terrain courses and other permanent test facilities are being utilized to put the loader through its paces. In these temperate and marine test environments, overall operational performance and safety characteristics are being tested under simulated but realistic mission-oriented conditions.

The loader is lifting, transporting and positioning a variety of containerized and palletized cargoes on rail cars, military trucks, and C–130 aircraft mock-ups. Studies relative to compatibility with other cargo-type aircraft are being made.

The loader will be used in simulated over-the-beach combat logistical operations to determine its ability to transport supplies while traveling through fordable depth surf to load and unload various types of watercraft and military lighters.

As each phase of this test progresses, a GETA maintenance evaluation team is making observations and periodic checks relative to the safety, servicing, and ease of maintaining the item in the field.

Design of the loader is also under constant surveillance to determine the compatibility of the item and the user, to include any excessive demands on human capabilities (operator and maintenance personnel), and adequacy of controls.

Maj Gen Haug Heads Engineer Division

Maj Gen Clarence C. Haug will become Southwestern Division Engineer for the Army Corps of Engineers, effective Apr. 1, succeeding Brig Gen William T. Bradley, who has been reassigned to Vietnam.

Maj Gen Haug has been commanding general, 2d Logistical Command, in Okinawa since 1965. From 1962 to 1965, he was chief of the Mutual Security Office, Army Materiel Command, in Washington, D.C., following duty as deputy director, Military Construction, in the OCE.

Engineer Corps Maintains Largest Force of Construction Talent

By F. M. Baumgardner

Directorate of Military Construction Office, Chief of Engineers

NOTE: This is the eighth of a series of articles started in the July-August edition on the Army Corps of Engineers' broad research and development activities.

One of the less publicized facts of vast and vital importance to the nation's welfare, as concerned with civil works costing taxpayers about $1.3 billion a year, is that the U.S. Army Corps of Engineers has the world's largest concentration of professional construction talent.

In times of war, capabilities of this huge force of designers and builders (currently more than 48,000 civilians, including over 9,000 engineers) are directed primarily to military requirements. In peacetime, the order of priority is reversed and the major effort goes to civil construction projects.

The Civil Works Program encompasses flood control, power, navigation, and related land utilization activities. Military construction effort is directed at Army and Air Force barracks, headquarters, housing, training, airfields and related facilities.

In the defense of the nation, military projects include complex facilities, such as the Sentinel System against the threat of a Communist China intercontinental ballistic missile attack, the Air Force missile systems, and the National Aeronautics and Space Administration (NASA) missile and space systems. In some instances, the Military Construction Program serves the Agency for International Development or foreign governments. Civil and military construction research needs usually may be identified with different missions. Still there are common or complementing areas of interest.

SEGMENTED reinforced concrete arch being erected at Waterways Experiment Station, Vicksburg, Miss., for test and evaluation as a shelter.

FULL-SCALE TEST TRACKS for evaluation of airfield rigid pavement systems at the Corps of Engineers Ohio River Division Laboratories.

Research efforts in support of Civil Works are identified in such areas as reinforced concrete, 3-dimensional stress effects in mass concrete, hydraulic structures, nuclear tracing in sediment transport in large streams, soil mechanics and soil testing, rock mechanics, and nuclear explosives as a construction tool. Civil Works research resources in these areas contribute support to many military needs.

In recent years, the Corps' research resources have not been able to keep pace with increasing magnitude and complexity of military construction. For this reason, a special committee of the National Academy of Sciences (NAS) was requested to advise the Corps on its construction research program and facility. Recommended, as a result of the NAS study, is a coordinated program which, although partly catalytic and adaptive in nature, incorporates vital specific research.

Furthermore, the study report recommended that future programs be systematically integrated with the over-all design, construction, operation and maintenance processes of the Corps. This approach was considered essential, since the traditional ad hoc type of research could not be effective with any foreseeable resources.

Findings of the study supported the need for a research facility which will be construction-systems oriented and which will be programed to function as an integral part of the Corps construction process.

This new facility is being designated the Corps of Engineers Construction Engineering Research Laboratory (CERL) and is to be located adjacent to and function in cooperation with the University of Illinois.

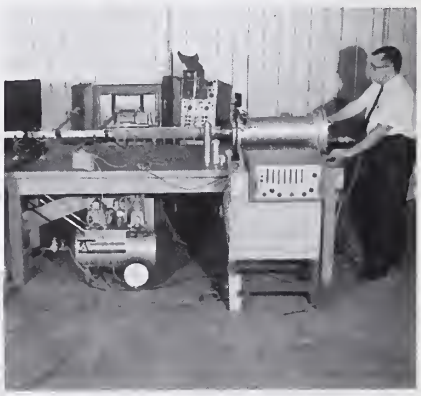
Research personnel, programs and equipment now located at the Corps of Engineers Ohio River Division Laboratories (ORDL) are scheduled to be transferred to this facility in July 1969.

A major consideration in design, construction, operation and maintenance of a facility is materials. Rapid advancements in science and technology require ever higher performance. Higher temperatures, greater loadings, dynamic forces, more hostile environments, higher speeds, greater shock loadings and numerous other factors are entering the design criteria of constructed facilities.

Soils (including rocks) are perhaps the most complex building or construction materials with which we deal today. Structures are built of soils or founded on soil. Research efforts are underway on a broad front to evaluate soil properties and behavior characteristics for unusual conditions such as dynamic loads and high-intensity shock loads.

Similar information is being sought for rock and rock-like materials which impose additional complications arising from joint-structure fractures and other factors.

In addition to material problems in continental U.S. facilities, the theater of operations currently imposes urgent requirements for deliberate and expedient effective soil stablization, airfield construction and protective construction. This construction sometimes involves use of unusual materials in pavements.



IMPACT LOADER for testing concrete at Ohio River Division Laboratories.

Waterways Experiment Station laboratory equipment for analysis and design of earthen structures, and research in soil mechanics/stabilizers.

Studies are in progress to determine, for worldwide applications, simpler and economically feasible methods of stabilizing or otherwise improving materials. Such materials are now under investigation from South Vietnam, Burma, Turkey, Panama and Afghanistan. Material improvement additives available from these countries have been evaluated.

The ORDL recently initiated a study to determine soils and soil stabilizers most suitable for the pressed-earth construction concept. The present state-of-the-art ranges from adobe and a single-block, manually-operated device to high-rate, masonry-block fixed plants.

Such plants are not presently available in the medium production range. The ability to use a broad range of soil types with appropriate additives or stabilizers for building blocks and pipe is being developed. The potential worldwide applications for pressed-earth building materials include storage buildings, temporary housing and small public or industrial buildings and sanitary systems.

Other material studies include development of a highly compressible foundation backpacking material which will provide a constant load-carrying capacity over large deformations. It has been shown that load can be related to the relative strength of the lined voids supporting a system.

Missile blast and fuel spillage is a continuing problem to NASA and Air Force structure environments. Development of blast-resistant materials, such as refractory brick and castable refractories, is a continuing need for NASA. Liquid oxygen spillage is hazardous with certain types of organic materials, since explosion can occur upon impact of an object on a LOX-saturated material.

Materials research is attempting to exploit fiber-reinforced plastic structural elements. Application to military building and structural systems include fabrication of integral components, such as telephone poles, piling, and round, square and rectangular tubing.

Other applications include the fabrication of members such as I-beams and channels. The applications of plastic materials could result in logistics savings of both weight and volume. In certain environmental conditions, they may prove most practical from performance or economic considerations.

One laboratory is investigating reinforcement for portland cement concrete and mortars using randomly placed fibers, steel wire and nylon.

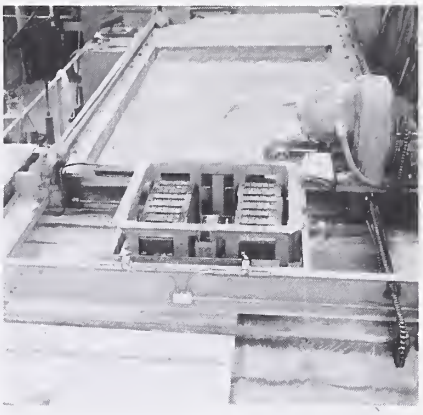
Resistance of these materials to dynamic loading is far superior to either plain or conventional steel-reinforced concrete. Under explosive, impact, or other dynamic loadings, the fibers in the matrix hold the system or member together. Thus, catastrophic failure or collapse, occurring in plain or conventional reinforced concrete, is prevented.

The Corps of Engineers research program is vitally concerned with natural, operational, and weapon-induced environments as they affect the total construction process.

For example, in cooperation with NASA, Corps laboratories are developing indexes for structural damage resulting from explosions of different types and quantities of liquid propellant. The indexes will be used in design of structures and determination of safe distances in missile-launch complexes.

Another investigation of techniques concerns protecting or isolating portions of construction operations so construction may proceed uninterrupted under severe weather conditions. Such techniques will permit better scheduling and optimum use of the work force.

SHOCK WAVE GENERATOR for testing experimental concrete at Ohio River Engineer Division laboratories.



REPETITIVE LOADING model for evaluating airfield rigid pavement systems at Ohio River Division labs.

Various types of protection, such as a single- or double-wall air-supported structures, framed structures, and structures with exterior supports are under consideration.

Further investigations are needed of maintenance, heating, ventilating, lighting, safety and other problems, including first cost and operating-cost data. Initial studies indicate that very effective utilization of these techniques is possible.

Increasing emphasis on air mobility continues to add importance to the capability for designing and building airfield systems. In past years, an extensive complex of criteria has been formulated from research and field experience and these criteria are continually updated and expanded. They cover conventional pavements for permanent military air installations and expedient airfields now common in the rapid-construction situations in Southeast Asia.

The Waterways Experiment Station (WES) recently completed a series of full-scale accelerated traffic tests which extend the airfield criteria, referred to earlier, to apply findings to "aircraft ground-flotation" requirements.

Resulting ground-flotation criteria have been used in design of the landing gear for the C5A transport plane to prevent it from overloading existing medium-load airfields and to permit its use on expedient airfields in the theater of operations.

Present design criteria for flexible, rigid or composite pavement systems do not include structural benefit derived from soil stabilization with lime and cement. A repetitive

(*Continued on page 20*)

CE Claims Largest Force of Construction Talent

(*Continued from page 19*)

loading model is being used at ORDL to conduct comparative tests, with and without stabilized layers, to evaluate performance and behavior of new pavement systems.

Maintenance material for pavements and concrete structures is essential for long-term satisfactory performance under increasingly stringent conditions. Thus, material properties, performance, and limitations for bonding and patching of pavements and structures are being evaluated.

Another study is underway to minimize interruptions to airfield operations and reduce maintenance costs. It concerns evaluation of physical and optical characteristics of airfield marking patterns and materials.

One aspect of construction research involving strategic systems is geared to the design and development of austere military protective shelters. Such shelters must be designed to resist nuclear and conventional weapons. An air-portable, easily erectable arch structure was designed to house a platoon for a buttoned-up period of one week during a nuclear attack. This earth-covered shelter, fully buried or in a cut-and-cover condition, can also be used as a command post or storage cubicle.

The system is designed to be erected by an engineer platoon in three days with minimum construction equipment. The arch structure is 16 feet in diameter and the length can be varied by increasing or decreasing the number of arch ribs. Various entrance ways are provided, depending on the use of the shelter.

A ¼-scale model of the structure has been tested in the WES Large Blast-Load Generator to withstand surface air overpressures up to 200 p.s.i. This prototype structure in a cut-and-cover configuration is currently being evaluated to determine its resistance to conventional weapons effects.

A more permanent, stiffer and smaller arch structure made of reinforced concrete was designed and tested to determine its resistance to conventional weapons. Its components can be fabricated in a staging area and transported to a field site. The structure is held together laterally by cables stretched between the two end walls and can be erected by six men in 1½ hours.

In addition to these structures, investigations are being conducted to determine and evaluate the structural response of components of several sophisticated defense systems such as Nike-X, Minuteman, and advance missile systems. These investigations will produce economic and reliable designs for specific systems as well as basic information for future requirements.

A research program in testing is necessary to develop, improve, calibrate and standardize techniques used in research, in quality control, and in post-construction surveillance of completed structures.

The Corps has developed in recent years greatly improved techniques for performing research on materials using X-ray diffraction, triaxial loading, shock loading, pulse propagation and other modern procedures. Similar advances in techniques have been and are being developed for control and surveillance purposes.

Some examples of nondestructive in-situ tests of structural elements are photoenergetic coatings, fatigue life gauges, spectrographic techniques, and techniques to verify chemical constituents. Simulation tests of nuclear and conventional explosives have been developed, utilizing the WES Large Blast-Load Generator.

This facility consists of (a) the large generator, capable of producing dynamic pressures up to 500 p.s.i. over a soil specimen 23 feet in diameter and 10 feet high, in which buried structures can be placed; (b) a small generator, capable of producing dynamic pressures up to 250 p.s.i. and static pressures to 2,000 p.s.i. over a 4-foot-diameter area; (c) a dynamic ram loader capable of delivering 200 kips in less than 2 msec.; and (d) a ram loader capable of producing 500 kips with rise times of 80 msec. and greater. Also available is a high-explosives test area where HE charges up to 830 pounds have been detonated.

In addition to the WES and ORDL, the Corps of Engineers maintains research and testing facilities at the Coastal Engineering Research Center, the Rock Island District Paint and Corrosion Laboratory, the Nuclear Cratering Group, and the testing facilities within the various field division laboratories.

The author wishes to express appreciation to Messrs. B. Mather, A. A. Maxwell and J. W. Flatau of USAEWES; and Messrs. S. J. Hubbard, D. Birkimer, R. Graham, A. Collishaw and W. D. Ford of ORDL for contributions to this article.

SPECIMENS at mean-tide level are alternately submerged and exposed to air at WES, Treat Island, Maine.

SCIENTIFIC CALENDAR

155th National Meeting of the American Chemical Society, San Francisco, Calif., Mar. 31–Apr. 5.

9th Structures, Structural Dynamics and Materials Conference, sponsored by AIAA and ASME, Palm Springs, Calif., Apr. 1–3.

Materials Engineering and Sciences Exposition and Conference, Philadelphia, Pa., Apr. 1–4.

4th Symposium on Thermophysical Properties, sponsored by the American Society of Mechanical Engineering, College Park, Md., Apr. 1–4.

9th Symposium on Engineering Aspects of Magnetohydrodynamics, Tullahoma, Tenn., Apr. 3–5.

6th International Conference on Magnetics, sponsored by IEEE, Washington, D.C., Apr. 3–5.

International Symposium on Numerical Solution of Field Problems in Continuum Physics, sponsored by ARO–D and AFOSR, Durham, N.C.,Apr. 5–6.

2d Communications Satellite Systems Conference, sponsored by AIAA, San Francisco, Calif., Apr. 8–10.

National Telemetering Conference, sponsored by IEEE, Houston, Tex., Apr. 9–11.

National Conference of the Society of American Value Engineers, Atlanta, Ga., Apr. 15–17.

Meeting of the Federation of American Society for Experimental Biology, Atlantic City, N.J., Apr. 15–20.

Cleveland Electronics Conference, sponsored by IEEE, Cleveland, Ohio, Apr. 16–18.

Symposium on Turbulence of Fluids and Plasmas, sponsored by the Polytechnic Institute of Brooklyn and the Microwave Research Institute, N.Y.C., Apr. 16–18.

Southwestern Conference and Exhibition, sponsored by IEEE, Houston, Tex., Apr. 17–19.

Conference on Interference Problems Associated with Operation of Microwave Communication Systems, sponsored by IEEE, London, England, Apr. 22–24.

Photochemistry and Radiation Chemistry Symposium, sponsored by Natick Labs, Natick, Mass., Apr. 22–24.

22d Annual Frequency Control Symposium, sponsored by ECOM, Atlantic City, N.J., Apr. 22–24.

5th Session of the Advisory Committee of the World Meteorological Organization, Geneva, Switzerland, Apr. 22–26.

Electrical Power Processes Conference, sponsored by IEEE, Cambridge, Mass., Apr. 23–24.

American Power Conference, sponsored by IEEE, Chicago, Ill. Apr. 23–25.

1968 Army Numerical Analysis Conference, sponsored by ARO–D, Fort Monmouth, N.J., Apr. 25–26.

14th Annual Technical Meeting and Equipment Exposition of the Institute of Environmental Sciences, St. Louis, Mo., Apr. 29–May 1.

Spring Joint Computer Conference, sponsored by IEEE and the AFIPS, Atlantic City, N.J., Apr. 30–May 2.

Garand Rifle Inventor's 54 Patents Set Goal for Rivals

If John C. Garand, inventor of the famous M1 "Garand" rifle, had performed 34 years of service at Springfield (Mass.) Armory in a later era, he could well have received some $58,000 for his patents and money-saving suggestions.

Regulations providing for incentive awards to U.S. Government employes for outstanding achievement came after his retirement in 1957. When he left he had a total of 54 patents attesting his creative genius.

In the unofficial *Army R&D Newsmagazine* search to find "The Man With the Mostest" patents among Army in-house laboratory personnel, chief scientist Dr. Henry P. Kalmus of the Harry Diamond Laboratories currently is leading with 40 patents and three applications pending. (See December 1967 edition of the *Army R&D Newsmagazine*, page 21.)

Inventor Garand served Springfield Armory as a consultant for about a year after retirement. He still lives in Springfield and undoubtedly will view the final phasing-out and closing of the 174-year-old armory next month as a personal loss.

The 80-year-old Canadian-born Garand is known as a modest man who plied his skills as small-arms designer and engineer to develop the first successful semiautomatic military rifle.

The M1 Garand earned its reputation as a superior combat arm in World War II. Its excellence was acclaimed by the most prominent military officers as well as by foot soldiers.

Garand's long, diligent tenure at the Arsenal earned many distinctive honors. He received the civilian Medal for Merit from President Roosevelt in 1944 for "exceptionally meritorious service" and in 1945 became the first employe at the Armory to be granted a special increase in salary and promotion by a Special Act of Congress.

His mechanical acumen went far beyond his best-known achievement, the M1 rifle. He devised new methods and built machines to improve quality and reduce costs of production. Armory officials have estimated the value of his contributions to improved performance in the hundreds of thousands of dollars.

Garand retained certain civilian patent rights to some of his numerous inventions (the U.S. Government owns any military patent rights obtained by a federal employe). However, he ignored opportunities to profit from them and concentrated on further work at the armory.

The U.S. continues to benefit from Garand's ideas. Much of the success of the Winchester M1 Carbine is attributed to numerous design principles he had developed and proved. The standard military M14 military rifle incorporates Garand ideas.

The *New York Herald Tribune* paid this tribute to Garand:

"With great success finally in his hands, he turned the M1 rifle over, for no great pecuniary reward, to the people of the United States; stuck to his lathe and sticks to it with the superior shrewdness of the man who knows that an opportunity to give to the world out of his unusual gifts is much rarer than the most tempting opportunities to make a lot of money."

Other honors accorded John Garand include: The Lord and Taylor Design Award; a special award from the American Society for Metals; the Rice Medal from the American Ordnance Association; the John Scott Medal from the City of Philadelphia; the Holley Medal from the American Society of Mechanical Engineers; the Pynchon Medal from the Publicity Club of Springfield; and a medal from the Franco-American Historical Society.

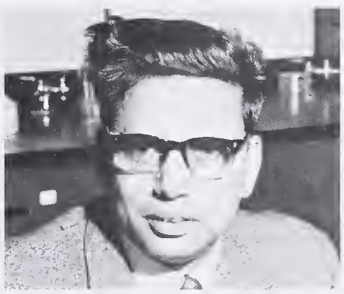
He also received an honorary degree from Lehigh University, but the most enduring tribute is the John C. Garand Bridge, deicated to honor him at Griswold, Conn.

John C. "M1" Garand

NAS Sponsors 2 Foreign Scientists at Natick

Scientists from India and Sweden are newcomers to the Army Natick (Mass.) Laboratories under the visiting research program sponsored by the U.S. National Academy of Sciences.

Dr. Tarun K. Ghose is professor of bioengineering and biotechnology at Jadavpur University, Calcutta, India. Dr. Benkt Goran Snygg is a graduate of the Swedish Institute of Food Preservation Research. They are assigned to the Microbiology Division of the Food Laboratory.



Dr. Tarun K. Ghose

Dr. Benkt Goran Snygg

Under the visiting scientists program, qualified U.S. citizens and foreign nationals may spend either one or two years in post-doctoral research in biology, biophysics, chemistry, organic materials, food and nutrition, geography and climatology, mathematics, physics, psychology, anthropology or textiles.

Dr. Ghose has reported results of his research in 44 scientific papers and has been granted 18 patents on inventions. He has been acclaimed for the development of food technology and biochemical engineering curricula and graduate programs at three Indian universities.

While at Natick his research will aim at conversion of cellulosic waste into edible foods. This effort is part of the worldwide attempt to restore the balance of man's food resources in an age of increasing population. The work has potential importance for feeding heavily populated countries with limited food resources such as India.

Dr. Snygg, who served as a research Fellow in zoophysiology at the University of Lund, Sweden, has contributed to four publications on the physiology and resistance of bacterial endospores.

Dr. Snygg's research at Natick may help develop new methods for lowering radiation levels used in the Army's program for long-term food preservation without refrigeration.

Designer Takes to Air for Knowledge

Lady Avionics Engineer Earning Pilot's License

When your work in an Army laboratory is concerned with electronic equipment under development for aircraft, you might take a more knowledgeable approach as a pilot.

That is the philosophy, or at least part of it, which prompted Mary Purvis, an electrical engineer in the Avionics Laboratory at the U.S. Army Electronics Command, to seek a pilot's license.

Mary is the first woman to become involved in the flight training program the Avionics Laboratory has been conducting since 1963. She is now soloing and expects to complete, in the near future, the FAA requirements for a pilot's license.

"That's the hard way to reach for high C," quipped one of her associates, familiar with her performance as the mezzo-soprano who in 1965 sang the lead in the Fort Monmouth, N.J., amateur production of "The King and I."

Graduated from Newark College of Engineering, she has been employed by the Electronics Command since 1960, but did not become a member of the Avionics Laboratory scientific staff until 1966.

Obtaining a pilot's license has never been the end objective of the Avionics Laboratory flight training program, stated Theodore Sueta, acting director of the lab, who with Lester M. Lang, a fellow employe, is credited with sparking the "flying scientists" research concept.

Demands on the Army R&D people have pyramided since the outset of the war in Vietnam, Sueta explains, and familiarization with actual aircraft performance is almost a primary requirement if an engineer is to work successfully to improve aviation electronics systems.

Since the inception of the aviation training program, 10 engineers in the Avionics Laboratory have obtained pilot's licenses and three have become licensed heliopter pilots. Fifteen laboratory engineers are taking flight training.

Mary Purvis

In the "ground school," however, operated by the ECOM Employe Development and Training Branch, 35 students are enrolled in Course AV-101, Elements of Aviation, which prepares them to pass the written portion of the FAA 2-part licensing examination.

Taught by Avionics Laboratory scientists Otto Schoenberger and Martin Post, the ground classes are open to all Fort Monmouth employes. Actual flying lessons are limited to Avionics Laboratory personnel selected as requiring training to improve their performance in R&D assignments.

Course AV-101 includes the elements of aerodynamics, air navigation, flight techniques, air traffic control, airborne communications and aviation meteorology. Classes are held once a week for three hours.

Students work with civilian planes and instructors at nearby airports to get the required 40 hours of flying time to pass the FAA tests. Twenty hours must be solo flights. The training is funded by the Army.

Schoenberger has attained both helicopter and fixed-wing pilot licenses under the program. Take it from him, the presence of an attractive, redheaded, single girl in the flight training program has tended to stimulate interest—in the training, that is, he soberly avers.

Tradition among Avionics Laboratory fliers is that a necktie must be sacrificed on the day a neophyte first solos. Mary Purvis soloed recently for the first time in a Cessna-150 single-engine, 2-seater.

A filmy yellow chiffon scarf, suitably mutilated, now hangs with the bobbed-off neckties on the pegboard in the Avionics Laboratory assigned to "the flying scientists."

APG Evaluating Armaments for Cayuse

Engineering tests to evaluate the XM27E1 armament system for the Army's OH-6A Cayuse helicopter are being conducted by Development and Proof Services at Aberdeen Proving Ground, Md.

Col Paul A. Troup Jr., director of D&PS, said the tests are part of the series of U.S. Army Test and Evaluation Command studies to evaluate durability, reliability, accuracy and human factors engineering of the weapon system.

The XM27E1 system consists of a single XM134 machinegun (7.62-mm Minigun) mounted externally on the left side of the aircraft with the ammunition box extending into the cargo compartment. Ammunition is fed from a 2,000-round capacity container and firing is electrically controlled from the cockpit by the pilot.

Prior to aerial test firing, the system was ground fired to insure safety. As of early February more than 300,000 rounds had been fired in aerial tests.

The gun can fire either 2,000 or 4,000 shots a minute, is fixed in azimuth, is flexible in elevation and can be depressed 24 degrees down and elevated 10 degrees. Its sight is an optical beam-splitter type mechanically linked to the system. Range settings can be made by the pilot during flight.

The primary tactical missions of the OH-6A Cayuse are visual observation, target acquisition, reconnaissance and command control. It has a range of 305 nautical miles, a cruising speed of 119 knots, and a hover ceiling of 11,460 feet. Its rate of climb is 2,120 feet a minute.

Quality assurance tests on weapon systems currently in production are scheduled at D&PS in the near future. Service tests of the airframe and other weapons subsystems have been conducted by the Army Test and Evaluation Command's Aviation Test Board at Fort Rucker, Ala., Hunter Liggett Military Reservation, Calif., and Yuma Proving Ground, Ariz.

ARMY Sp/6 Thormon O. Ellison, a test director with Development and Proof Services, adjusts a radio interference monitoring device during tests on the XM27E1 armament system. Firing the weapon from the cockpit is pilot Capt Gerald Wright, assigned to Phillips Army Air Field.

MERDC Multifuel Engine Reduces Costs

Fuel economies up to 30 percent for a new multifuel "stratified charge" industrial engine developed under contract are reported by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

The successful testing was done on a Model 2A042 Military Standard Engine, rated at 10 hp. and incorporating the strato-charge system. Fuel consumption was decreased 30 percent, using the full range of military fuels, without a sacrifice in peak performance, analysts reported.

Developed by Texaco, Inc., under a $98,020 contract, the prototype engine has a combustion system which involves a coordination of fuel injection and positive ignition with swirling air.

The first increment of fuel is injected at the time of ignition. Additional fuel is burned approximately as fast as it is injected. This and the positive ignition eliminate octane and cetane numbers as relevant fuel qualities, regardless of compression ratio, researchers report. Fuel injection permits the use of hydrocarbon fuels of a broad boiling range.

The system was applied with minimum modification to the standard engine, which enabled the engine to retain complete interchangeability with most applications now filled by the standard 2A042 engine.

Used as a power source for the 5-kw. Military Design Generator Set, the 2A042 engine is a member of the Army's family of 5 small air-cooled gasoline engines ranging from 1.5 to 20 hp.

The cylinder head used for the conversion represents the greatest single change from the original gasoline design. The compression ratio was increased from 6.8:1 to 9.6:1; the dry weight of the engine from 142 to 150 pounds; the width from 27.81 to 29.75 inches; and the maximum horsepower on gasoline, at 3,600 r.p.m., from 16.8 to 17.1.

During developmental testing and evaluation, 200 hours of operation were accumulated on the prototype. Extensive use was made of automotive combat gasoline, compression ignition and turbine engine (CITE) fuel, and diesel fuels, with briefs checks with JP-4 and JP-5 jet fuels and 115/145 aviation gasoline.

The engine demonstrated good operation without knock or misfire on the three primary fuels. Multifuel capability, good operation and improved fuel economy was retained under air inlet conditions simulating altitudes of 5,000 and 8,000 feet.

In cold starting tests at -10 and -25°F., gasoline performed excellently and CITE fuels satisfactorily. Endurance life characteristics of the engine are under evaluation.

Successful preliminary testing of the prototype engine has resulted in the Mobility Equipment R&D Center awarding Texaco a $99,352 contract to convert six additional 10 hp. standard engines to the stratified-charge combustion system. These will incorporate "preproduction type" components and modifications, and will be evaluated for end item applications.

Texaco is also working under contract with the Army Tank Automotive Command to adapt the Texaco Combustion Process (TCP) to the L-141 engine which powers the M-151 vehicle, successor to the Jeep of World War II. This program also has achieved improved fuel economy and multifuel capability.

MERDC Engineer Uses Job Skills in Racer-Building Hobby

When man's regular day-by-day work duties tie-in with his hobby, or vice versa, that's what happiness is! One such fortunate individual is Charles R. Sarle, 40, of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

A project engineer in the MERDC Prime Mover Branch, Sarle has been involved in development and test of the 6-, 10- and 20-hp. Military Standard (MS) engines, including use of the supercharging principle. That fits in perfectly with his hobby of car racing.

Sarle has the distinction of having successfully turbocharged two gasoline racing engines, including one which powered the first turbocharged gasoline engine race car in this country or Europe. He also has achieved success at the MERDC as a Civil Service employe.

In his work he has shown that the 10-hp. MS engine could, with minor modifications and little increase in end-item cost, power a lightweight 10-kw. generator set; also, that the turbocharged 20-hp. MS engine could be adapted to 15 through 30-kw. generator sets.

Sarle's work led to his selection by the Electrotechnology Department as its nominee for the 1967 Commanding Officer's Technological Achievement Medal. The award, however, went to Richard W. Helmke of the Military Technology Department for his work on a marginal-terrain assault bridge now being evaluated in the Vietnam War.

Sarle began racing as a car builder and driver in a dirt-track roadster in 1948. In 1953, he began competing in AAA (American Automobile Association) sprint car races and in sports car road racing. He has competed on all the major road race circuits in the east and midwest, including the famed race in Sebring, Fla. He has driven an RSK Porsche, A. C. Bristol, A. C. Jaguar (turbocharged), and his present sports racing car (F.I.A. Group 7).

"I designed and built it expressly for professional road racing," Sarle said. "It is equipped with a 500-hp. turbocharged engine. This I developed by using the block and aluminum head castings of an F-85 Oldsmobile. The car weighs 1,300 pounds and is the only front-engine car running in this circuit."

The first turbocharged gasoline engine race car, in this country or Europe, he said, was "an A.C. which I bought from the factory without engine and in which I installed a 400-hp. turbocharged Jaguar engine in 1958. The A.C. is an English-built sports car. The A.C. later was used by Ford-Shelby American to build the Ford Cobra sports car."

Sarle said his future plans include improving the torque range of the engine of his present car, in preparation for a full race season starting next spring. In the more distant future he would like to build turbocharged racing engines on a contract basis.

A native of Alexandria Va., Sarle is an Army veteran who studied at Pennsylvania State University under the ASTP (Army Specialized Training Program) in 1945, and later served in Korea. He studied at Virginia Polytechnic Institute and at George Washington University in 1947–48 and he has been employed at the Army Mobility Equipment R&D Center since 1951.

PROJECT ENGINEER Charles R. Sarle behind the wheel of his sports racing car (F.I.A. Group 7), equipped with 500-hp. turbocharged engine.

Fort Detrick's Silver Anniversary Length of Service Awards Ceremony Feb. 2 was highlighted by the conferring of high honors upon four veteran employes. Maj Gen Frank G. White, CG of the U.S. Army Munitions Command, presented awards.

EXCEPTIONAL CIVILIAN SERVICE. *Dr. Riley D. Housewright*, who has served as technical director of the facility since 1956, received the Army's highest civilian award.

Dr. Housewright began his association with R&D at the Maryland installation in 1943 as a naval officer. Internationally recognized now as an authority in microbiological R&D, he specializes in chemotherapy and physiology of pathogenic bacteria.

MERITORIOUS CIVILIAN SERVICE. Three Fort Detrick scientists received the MCS Award.

Dr. Harold N. Glassman, who started at Fort Detrick as an Army officer in 1944 and became a civilian employe in 1946, was commended for his outstanding scientific and managerial contributions as assistant technical director for research.

Dr. Glassman has written numerous publications describing his investigations in biochemistry. His major areas of interest are the permeability of the erythrocyte, the growth and storage of *Brucella suis*, the isolation and characterization of Type B botulinal toxin, and surface-active agents and their application to biologically important systems.

He has been a member of the Maryland Governor's Science Resources Advisory Board and was recently elected to a 3-year term on the Board of Governors of the Scientific Research Society of America.

Dr. Robert A. Altenbern was honored with the MCS Award. He began his employment at Fort Detrick as a medical bacteriologist in 1949 and has served the past four years as chief, Microbial Physiology Branch of the Medical Bacteriology Division, Biological Sciences Laboratory.

An international authority on microbial genetics, he has made significant contributions to studies on carbohydrate and amino acid metabolism, synthesis of extracellular products, and chromosomal mapping of pathogenic bacteria (see page 25 of the June 1067 edition of the Newsmagazine).

Dr. Henry T. Eigelsbach also received the MSC Award. A medical bacteriologist, he has served at Detrick since 1944, the past 19 years as chief, Bacteriology II Branch, Medical Bacteriology Division of the Biological Sciences Laboratory. He was lauded for making significant contributions to studies on pathogenicity, immunological response and vaccine prophylaxis of infectious diseases.

Dr. Ross L. Gauld, director, Division of Preventive Medicine, Walter Reed Army Insitute of Research (WRAIR), received the MCS Award for his work at the Institute from September 1946 through August 1967. His citation noted that "his contributions to military medicine and to civilian science as a teacher, consultant and researcher have been outstanding."

At the U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala., two members of the Pershing Project Office received MCS Awards.

Clarence A. Tidwell Jr., a special projects officer in the Pershing Office, was cited for four years of service as special projects officer and special assistant to the Pershing project manager.

During this period he was directly responsible for various projects and studies which had a significant impact on the establishment and fulfillment of the system's Quick Reaction Alert role.

James F. Connor, chief of the Pershing Project's Firing Operations Division, Cape Kennedy, Fla., has for seven years been responsible for attainment of all flight objectives in a comprehensive series of tests requiring worldwide participation. He has been technical test director for over 120 Pershing firings.

Outstanding performance in R&D program management recently earned the MCS Award for *Jeremiah F. Regan*, chief, Management Services Division, R&D Directorate, U.S. Army Electronics Command, Fort Monmouth, N.J. He was cited for work during the period September 1966 to August 1967.

PATRIOTIC CIVILIAN SERVICE. *Dr. Thomas R. Porter*, head of science education at the University of Iowa, received the Patriotic Civilian Service Award for his many contributions to the U.S. Army Junior Science and Humanities Symposia Program.

The presentation was made by Brig

Blind Seamstress Sews MICOM Name Tapes

Responsibility, reliability and resourcefulness are used by Josie M. Randolph, who has been without sight all of the 50-odd years of her life, in demonstrating her ability to "carry her own weight" in the struggle to earn a living.

"Miss Josie" has a contract with the U.S. Army Missile Command at Redstone Arsenal, Ala., to sew 60,000 name tapes and U.S. Army identification tapes on field type uniforms for the Redstone quartermaster.

Fierce pride in her independence has made her resourceful and aggressive about making her own way since she left the Alabama School for the Blind in Talledega. There she learned typing, hand sewing, basket weaving and the usual academic subjects. Later she learned to use and maintain a sewing machine.

Josie M. Randolph

Until she signed the contract last November to sew the tags on uniforms, Miss Josie had worked for other Army and Navy contractors. About two years ago she wrote to the Small Business Administrative Office in Atlanta, requesting that she be considered for a sewing contract.

"I can sew on about 200 tapes a day," she said. When there is a large volume of uniforms on hand, she employs a couple of assistants. In order to get the tapes on right side up and out, she employs a helper to pin them on. Then, zing, she sews. She also folds the uniforms and fits them back into shipping cartons.

Another of her sources of income is a Birmingham diaper service. She has been making receiving blankets for about 10 years. She also makes her own clothes, explaining: "I can cut out things by using a tissue pattern. I sew the pieces together by following notches cut in the edges."

Skilled as a typist, she prepares invoices for work she does.

Miss Josie does not see herself as a possible example of courage and persistence against adversity. Pride in herself is her answer to pity.

Gen W. J. Durrenberger, CG of the U.S. Army Weapons Command, Rock Island, Ill. Dr. Porter has directed the Iowa regional JSHS program since 1962.

GALLANTRY CROSS. South Vietnam's highest award, the Gallantry Cross with Palm, was awarded recently to *Capt Walter J. Marm Jr.*, aide-de-camp to Lt Gen Harry W. O. Kinnard, CG of the U.S. Army Combat Developments Command, Fort Belvoir, Va. Capt Marm also holds the United States' highest award, the Congressional Medal of Honor.

The chief of the Joint General Staff of South Vietnam called Capt Marm a "courageous officer who exhibits an enthusiastic combat spirit during all military operations." He was cited specifically for his actions during the Plei Me operation, Oct. 23 to Nov. 29, 1965.

Moving to relieve a unit surrounded by a Viet Cong regiment, the then Lt Marm and his platoon withstood heavy automatic weapon fire from a Communist bunker. Finally they were forced to take cover. Deliberately exposing himself to draw enemy fire, he fired an antitank rocket into the bunker.

Lt Marm then grabbed two grenades and his machinegun, charged across open ground under continuing enemy fire, and threw the grenades into the enemy position. His jaw shattered by an enemy bullet, he continued driving ahead, killing the remainder of the Viet Cong, 12 in all.

DISTINGUISHED SERVICE MEDAL. *Maj Gen Richard J. Meyer* received the DSM, the nation's highest noncombatant military honor, upon his recent retirement as commander of the U.S. Army Strategic Communications Command (STRATCOM). General Harold K. Johnson, U.S. Army Chief of Staff and a U.S. Military Academy classmate of General Meyer, made the presentation.

The citation noted that he distinguished himself by eminently meritorious conduct in the performance of outstanding service in successive positions of great responsibility, May 1958 to February 1968.

JOINT SERVICE COMMENDATION. *Lt Col Norman L. Durocher* received the Department of Defense Joint Service Commendation Medal for "distinguishing himself by meritorious service as Army member, Joint Meteorological Satellite Program Office (JMSPO) over the period November 1966 to January 1968."

Col Durocher until his recent retirement was assigned to the Environmental Sciences Division of the U.S. Army Research Office, Office of the Chief of Research and Development (OCRD).

BRONZE STAR MEDAL. *Lt Col Hughey L. Weston*, Davison Army Airfield, was presented the BSM for outstanding service while with the 25th Infantry Division as an Army pilot. *Capt James V. Donadio*, an internist in the Medical Clinic, Walter Reed General Hospital, received the BSM for his service with the 3d Field Hospital, Vietnam. *Capt Stephen C. Boone*, a student in WRAIR's Global Medicine Course, received the BSM for his epidemiological research with the Special Forces Medical Research Team.

AIR MEDAL. *Maj William R. Briot*, MSC, aviation staff officer in The Army Surgeon General's Aviation Branch, Directorate of Plans, Supply and Operations, received the 13th OLC to the Air Medal for meritorious achievement while participating in aerial flight in Vietnam, Mar. 9-21, 1967, while commanding the 283d Medical Detachment (Helicopter Ambulance).

ARMY COMMENDATION MEDAL. *Col George D. Scarborough*, now a test director in Joint Task Force Two's Operations Directorate, Sandia Base, N. Mex., was awarded the ACM for his service in OCRD, May 1963 to March 1967. As a staff officer and chief of the Long Range Plans Branch, he was cited for his ability as a planner, coordinator and supervisor in joint and Department of the Army staff operations.

Lt Col John C. Alford was awarded the 2d OLC to the ACM for his work as R&D coordinator in the Intrusion Detection and Sensor Laboratory at the Army Mobility Equipment Research and Development Center (MERDC). He is now in Vietnam.

Nurse of Year Honors Recognize Vietnam Heroism

"U.S. Army Nurse of the Year" honors were conferred on Lt Col Sara N. Lundy as the Army Nurse Corps marked its 67th anniversary, Feb. 2.

Selection was based on her contributions to the Army Medical Service as chief nurse, 45th Surgical Hospital in Vietnam, and her continued leadership and initiative as nursing methods officer in the Directorate of Plans, Supply and Operations, Office of The Army Surgeon General.

In May 1966 Lt Col Lundy was assigned to Fort Sam Houston, Tex., to the 45th Surgical Hospital, the initial Army hospital to employ the MUST (Medical Unit Self-contained Transportable) concept. She was responsible for the operational readiness of the patient care areas in preparation for the unit's deployment to Vietnam.

On Nov. 4, 1966, as the hospital was being established at Tay Ninh, Vietnam, the hospital commander, Maj Gary Wratten, MC, was killed in an enemy mortar attack.

Lt Col Sara N. Lundy

Lt Col Lundy's positive leadership during this stressful period is credited with motivating those around her. She assisted the new commander to meet the scheduled opening date and to provide unexcelled patient care for those wounded in "Operation Attleboro." She was awarded the Legion of Merit for sustained meritorious service with the hospital.

Since her return from Vietnam in June 1967, she has continued to demonstrate her dedication to the mission of the Army Nurse Corps and Army Medical Service as a guest lecturer at military and civic affairs.

Lt Col Lundy's tour in Vietnam was not her first experience with a crisis situation. While assigned as chief nurse of the 8th Evacuation Hospital in Germany, her unit was sent to Skopje, Yugoslavia, to assist their medical teams following the 1963 earthquake.

When the Mayor of Skopje came to Washington in the summer of 1966, he brought an engraved plaque from the grateful people of his city to Lt Col Lundy for her contributions to medical needs in a disaster.

Lt Col Lundy graduated from the Baptist Hospital School of Nursing, Birmingham, Ala., in 1948 and attended Birmingham-Southern College until called to active duty from the Reserve in 1951. She began her military career with a tour of duty at Walter Reed General Hospital, followed by a 2-year tour in Alaska.

She holds a BS degree in education from Indiana University and a master's degree in hospital administration from Baylor University.

Glamour in Cross-Country Mobility Equipment

By B. H. Gundel

Army Tank-Automotive Command
Warren, Mich.

Machines moving across rough terrain with the speed and maneuverability of 4-legged animals are no longer impossible. Prospects appear promising for far-reaching advances in design and development of off-the-road vehicles with qualities offering some of the glamour which has become associated with aerospace and computers.

The prospect of dramatic improvements arises because land mobility equipment engineers are learning to imitate nature in ways which had previously been thought to be impossible or at best impractical.

Aircraft shaped like birds and submarines shaped like fish have outperformed certain of the capabilities of these creatures by a wide margin. With respect to improvements in cross-country mobility equipment, man has so far failed to achieve the ultimate in efforts to imitate nature in design efficiency. In many respects his machines do not match the performance of animals. Ten miles an hour is a good average cross-country speed for tracked vehicles presently in production; admittedly, few animals can long sustain that speed.

Wheeled vehicles, of course, were really designed for smooth roadways and not for natural terrains which may be extremely adverse. However, jungle trails, rugged hills swamps and river banks must still be traversed, and guerrillas must be pursued where they hide.

The wheeled vehicle that carries its own road with it, the track, is an improvement in many situations, but horses can on occasion outperform $250,000 tanks.

The wheel has been the basis of technological progress, but it does not always provide optimum travel across unmodified terrain. Animals that have survived the long process of evolution move from place to place on multi-jointed legs.

The trouble has been that, as recently as in 1960, top experts did not believe the technology was available for development of a leg-like, mechanical device which could match or outperform nature.

Quadruped. In spite of the great technological problems, the Advanced Research Projects Agency (ARPA), Department of Defense, began in 1964 to sponsor research and exploratory development of mechanical, leg-like structures.

Fig. 1. WOODEN MOCK-UP of 4-legged vehicle developed at ATAC.

The Land Locomotion Division, Mobility Systems Laboratory, at the U.S. Army Tank-Automotive Command ATAC at Warren, Mich., was given the responsibility for guiding this effort, and the subsequent development and test of full-sized research prototypes.

Figure 1 is an early wooden mock-up of a 4-legged research vehicle developed under guidance of Ronald Liston, chief of the Land Locomation Division, and currently under construction. Liston is chief of the Land Locomotion Laboratory at ATAC and project engineer of the Quadruped Walking Machine Program.

Figure 2 shows the legs jointed like those of man. In fact, tests have proved that an operator can quickly adapt his instinctive sense of equilibrium to balance and tilt the quadruped and to "walk the vehicle" according to his needs.

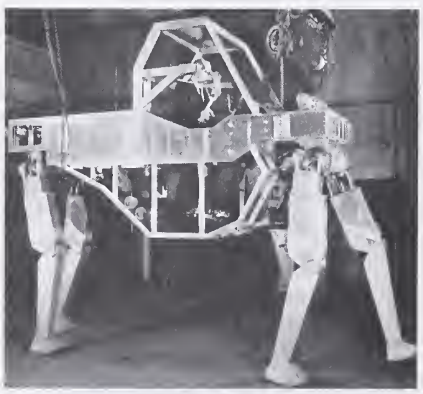


Fig. 2. WALKING-TRUCK test bed being assembled at General Electric Co.

The mechanical linkages function as powerful extensions of his limbs. He "feels" ground impact, softness and hardness through a hydraulic force-feedback control system.

In this manner, an operator will be able to negotiate a steep slope, step sideways, surmount 6-foot-high obstacles, turn around on the spot, and minimize terrain unevenness through adroit positioning of the feet.

In soft soil, a variety of shoes can be fitted to obtain desirable ground pressures. Efficiency will be high because the ground will be compacted intermittently. Wheeled and tracked vehicles require energy to compact soft terrain in a continuous trace.

The hydraulically operated legs will function as ride stabilizers and as shock absorbers; they also will permit squatting for easier loading and to avoid detection. A later version could be operated on smooth terrain in a fixed, automatic cycle, or have excellent mobility on mountain trails, in jungles, on rough surfaces, and across fields crisscrossed by canals and waterways.

A 4-legged, 500-pound capacity, walking-truck test bed will be completed next month. Conceivably it may be the forerunner of a fleet of logistic, load-carrying walking trucks which can be operated wherever a man can go, but with an improved forced-march capability.

Accommodating Suspensions. Substantial increases in mobility are expected from the next generation of tracked vehicles. At present, the driver is jolted and bounced so that vehicle control is affected at all but the lowest cross-country speeds.

To provide improved riding quality, highly flexible springs having exponential rather than linear spring rates are required; with these, spring reaction rapidly increases as spring stops are approached.

To meet this objective and to provide quick damping, a combination air/hydraulic system, called the hydropneumatic suspension, was developed at the U.S. Army Tank-Automotive Command under the guidance of Robert Otto, acting director of the Mobility Systems Laboratory.

The suspension is able to raise the vehicle body and furnish the ground clearance required to pass over some rough obstacles; also, to let the body down so as to lower overall profile and enhance stability characteristics. The principles have been incorporated

in a system applied to the U.S./Federal Republic of Germany Main Battle Tank for the Seventies.

The vibration experienced by the driver in present vehicles is indicated schematically by the heavy, wavy line in the upper left hand of Figure 3. The new suspension permits conformity of the lower tracked surface with the road profile, and is illustrated schematically at the upper right of the same figure. Irregularities of the road surface are isolated from the driver for a smooth ride.

Terrain Sensing. Additional substantial increases in cross-country speeds are made possible by sensing the terrain ahead of the moving vehicle, as hown in the lower illustration of Figure 3.

Tracked and wheeled vehicles equipped with the hydropneumatic suspension may benefit from this system, currently in exploratory development at the Tank-Automotive Command. Work is under the direction of Edward J. Gow Jr., acting chief of the Frame, Track and Suspension Division.

Sensing can be done with sound waves, visible light, lasers and microwaves. A breadboard, inertia-controlled, active suspension has been evaluated under field conditions, and demonstrated a 30 percent improvement in ride dynamics. Size, shape and distance of obstacles were determined with reliable precision.

The sensors define surface contour and consistency and the vehicle is operated automatically at the maximum speed appropriate to the situation. Moreover, at each ground contact point, the suspension is made to compensate actively and differentially for the anticipated variations in height of the terrain underneath.

Position of the wheels inside the track is hydraulically adjusted to the height of changing terrain contact points, as shown in the lower illustration of Figure 3. The vehicle body is kept even and becomes a stabilized platform for firing on the run.

It is interesting to note that each ring of the lowly, creeping earthworm adjusts similarly to the uneven, soft ground surface, and that nature developed this type of mechanism for an animal which lives primarily in weak soils.

Flexible-Frame Vehicle With Elliptical Wheels. Matching of vehicle contact points to the profile of the ground is also accomplished by flexible connections between wheel axles, as shown in Figure 4. Each wheel axle supports an individual load carrier and is connected to the other units by means of heavy coil springs.

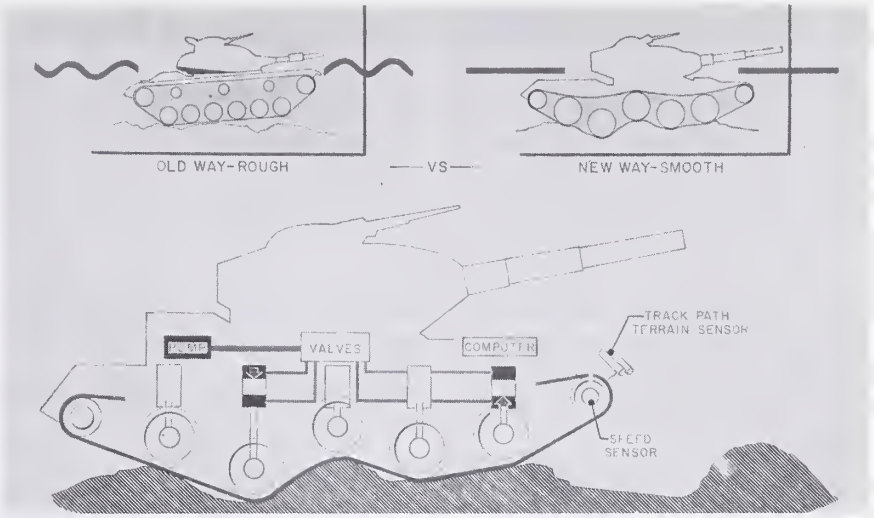


Fig. 3. RIDE CONTROL showing hydraulic adjustment of wheels to terrain.

Substitution of elliptical wheels for the conventional wheels and tires, as shown in Figure 4, produces a combination which operates efficiently on river banks, in soft soil, on unprepared, difficult cross-country terrain and on highways.

The elliptical wheel is undergoing exploratory development and is expected to be in use by the mid-70s. It provides approximately 70 percent more traction than a comparable circular wheel on clay-type soil, due to the increase in contact area. Elliptical wheels represent a transition between conventional wheels and tracks.

Since the heavy coil articulation between carriers permits freedom in pitch, roll and yaw, the wheels of each unit can retain contact with the varying heights of uneven ground surfaces. Consequently each wheel is better able to provide the intended tractive and weight support function.

When one unit negotiates an obstacle, the others help by pushing or pulling it. The springs provide a dynamic bouncing effect which increases obstacle performance. This type of vehicle will negotiate an obstacle of greater height than the diameter of the wheel.

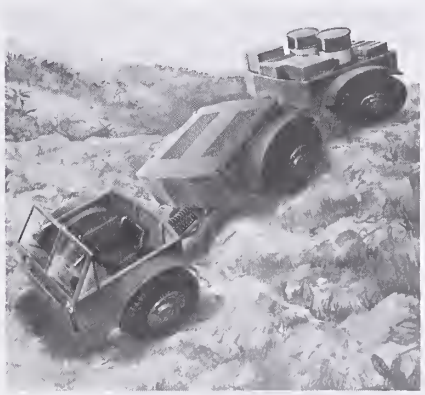


Fig. 4. CONCEPT of flexible frame vehicle with elliptical wheels.

Standard military vehicles would have difficulties in negotiating most river banks encountered in the United States. The vehicle shown in Figure 4, however, is estimated to be able to surmount 80 percent of the banks.

The concept originated with M. G. Bekker, a former chief and founder of the Land Locomotion Division, and Ronald Liston, his successor. Because of his extensive pioneering work, Bekker has been called "The Father of Modern Land Locomotion."

Conclusion. Various concepts are being studied and developed for transporting heavy loads wherever man can go, and at speeds and with endurance far beyond human capability.

The ground-contact members of a coming generation of cross-country vehicles will adjust themselves to make individual contact with rough terrain surfaces.

Other vehicle types have been conceptualized to incorporate stable and level platforms for the performance of work, and to permit quick lowering and tilting of platforms for loading and unloading.

Potential applications in the oil drilling, pipe laying and logging industries are staggering, and cross-country operations of all types are likely to receive a tremendous boost.

Technological glamour has always been found where new frontiers are opening up and where technology promises to bring vast improvements in a relatively short time.

Army Board OKs $40 Million Water Resources Program

Proposed water-resource projects totaling an estimated $40.4 million were recommended for approval by the U. S. Army Board of Engineers for Rivers and Harbors at a February meeting in Washington, D. C.

Cost of another board recommendation for beach erosion control in Brevard County, Fla., (at the City of Cape Canaveral and the Indialantic-Melbourne Beach area) could not be estimated. The source of some 1.5 million cubic yards of sand must first be determined, along with costs of beach replenishment over a 10-year period.

Board-recommended projects and estimated costs are as follows:

- Construction of about 10½ miles of levees for both sides of the Alabama River at Selma to mitigate flood losses occurring about once every two years. (The system would include a section of flood wall, pumping station, ponding areas and drainage structures. Estimated cost is $7.08 million, of which local interests would pay $685,000.)
- Deepening and widening the ship channel through Sergius and Whitestone Narrows, Alaska, between Sitka and Juneau, including removal of shallow rock outcrops. Cost: approximately $3.03 million.
- A flood control and recreation project at Fairfield, Calif., involving construction of about 14 miles of channel improvements on five streams for expected prevention of $405,000 annual flood damage. First costs of flood control, $4.86 million, and recreational features, $360,000, would be divided equally between federal and nonfederal interests.
- Construction of a small-boat harbor at New York's Hamlin Beach State Park on Lake Ontario, 20 miles west of Rochester. Cost: about $1 million, to be shared by the U. S. and New York State governments.
- Five local-protection levee projects along the Mississippi and Rock Rivers at Clinton and Bettendorf, Iowa, and Fulton, East Moline and Milan, Ill. Cost: About $24 million, including $2.77 million nonfederal funds. The projects are expected to prevent an average of $2.2 million annual flood damage.

Maj Gen Robert G. MacDonnell, president of the Mississippi River Commission, is chairman of the 65-year-old independent board which meets periodically to review proposed water-resource developments of the Army Corps of Engineers.

Pershing Motor Test Points To Extension of Shelf Life

Successful static firing on a 7-year-old Pershing missile motor give promise of extending the shelf life of this equipment, with considerable monetary savings to the Army. Original shelf life of these motors was required to be five years.

Conducted at the Army Missile Command's Redstone Arsenal facilities, the test was run on a second-stage motor manufactured in November 1960. All original acceptance criteria were met, demonstrating the inherent reliability of the Pershing-type solid-propellant motors.

The motor was tested as part of an Aging and Surveillance Program at Redstone Arsenal aimed at demonstrating the continuing service life of Pershing solid-propellant motors.

Pershing is managed by the Army Missile Command, with Lt Col Edwin A. Rudd as project manager. Martin Marietta Corp.'s Orlando Division is prime contractor. Thiokol Chemical Corp. is subcontractor for the motors.

Microbiology Society Votes Honor to Army Scientist

Dr. Carl Lamanna, deputy chief and scientific adviser of the Life Sciences Division, U.S. Army Research Office, was elected recently by the American Society of Microbiology (ASM) to a 2-year term as a councilor-at-large.

Prof. H. E. Swim, professor of microbiology, Western Reserve School of Medicine, Cleveland, Ohio, was elected to serve with him.

Dr. Lamanna is coauthor of a comprehensive text on microbiology and has been an active member of the ASM for some 30 years. He is serving on the editorial board of the *Journal of Bacteriology*, official ASM publication, and has served on the society's program committee on general microbiology. ASM headquarters is at Ann Arbor, Mich.

ASM members elected Dr. Dennis W. Watson president for the 1968-69 term. He is professor of microbiology and head of the Department of Microbiology, University of Minnesota Medical School.

Dr. Watson is now vice president and will succeed Prof. Salvador E. Luria, department head and professor of biology at Massachusetts Institute of Technology, when new officers assume duties in July.

The ASM promotes scientific knowledge of microbiology and related subjects, and stimulates scientific investigations that will advance knowledge in the field. Dedicated also to the improvement of education, it was organized in 1900.

AMMRC Swears In New Technical Director

Dr. Eraldus Scala has been sworn in as technical director of the U.S. Army Materials and Mechanics Research Center, Watertown, Mass., but will not report for full-time duty until Sept. 1. Currently he is in the Netherlands as a Guggenheim Fellow.

Known for his achievements as a metallurgical chemist with various industrial firms, Dr. Scala has served since 1961 at Cornell University as professor of metallurgical and materials sciences.

Among his professional credentials are a BS degree from City College of New York, an MS degree from Columbia University in 1948 and a doctorate in metallurgical engineering from Yale University in 1953.

After serving as a metallurgical chemist with Ledoux and Co. since 1943, he went to Columbia University as a research associate on a U.S. Atomic Energy Commission project in 1947–48. For the next seven years, he was employed by Chase Brass and Copper Co. as a research metallurgist.

Dr. Eraldus Scala

From 1955 to 1961, he was manger of the Materials Department, Research and Advanced Development Division of the AVCO Corp. His field of scientific research is physical metallurgy, high-temperature materials and liquefied metals.

Professional recognition has included selection as a consultant to the Aerospace Corp. and the Battelle Memorial Institute, and membership on the Advisory Boards on Materials of the National Aeronautics and Space Administration and the National Academy of Sciences.

His affiliation with professional societies includes the American Institute of Aeronautics and Astronautics, American Society for Metals, and American Institute of Mining, Metallurgical and Petroleum Engineers.

Tank Tests May Revolutionize River Crossings

Several 3-man Army scuba diving teams will drop into a river Apr. 1 at Fort Hood, Tex., to begin troop tests that could revolutionize movement of tanks across inland waterways.

The divers will be checking the river to determine its depth, steepness of its banks and amount of mud on its bottom. Special Forces personnel will act as divers for the week-long test. Specially trained Armor personnel will serve as divers in future tests.

After the reconnaissance mission, M-60 series tanks will attempt a river bottom crossing of the stream with only a conning tower above water. Presently, either rafts or bridges must be built before tanks like the M-60 can cross rivers.

The idea of river-bottom reconnaissance for deep-water fording by tanks was conceived and developed by the Army Combat Developments Command (CDC), Fort Belvoir, Va.

The M-60 tank is completely sealed and equipped with an inner tube device which can be inflated with air carried aboard the tanks. With the conning tower, the tanks can navigate in 13½ to 15 feet of water; without the tower, maximum depth is 8 feet.

The idea was developed with the waterways of Europe in mind and tests will seek to prove that tanks can cross, underwater, a river as large as the Rhine.

The CDC Armor Agency at Fort Knox, Ky., did the preliminary planning for the test. Tank battalions from the 1st Armor Division will participate in the test and an aggressor force will be used to simulate combat conditions in night and daylight hours.

Canada has expressed interest in the project and will witness the tests, along with representatives from the Army Materiel Command, CDC Armor Agency and CDC headquarters.

Technical Papers Invited For Army Math Conference

The Army Mathematics Steering Committee (AMSC) is calling for papers for presentation at the 14th Conference of Army Mathematicians, June 12–13, at Rock Island Arsenal, Ill.

Apr. 23 is the deadline for submission of papers to Dr. Francis G. Dressel, Mathematics Division, Army Research Office-Durham, Box CM, Duke Station, Durham, N.C. 27706. Personnel from Army activities desiring to attend the conference should contact Dr. Dressel.

Approximately 60 delegates from Army facilities will participate in the 2-phase program, consisting of about 30-minute technical or clinical papers presented by about 20 Army personnel and one invited address by a nationally known mathematician.

Army personnel desiring to propose papers should include the title of the paper, time required, name of speaker, desired address (i.e., Weapons Systems Laboratory, U.S. Army Ballistic Research Laboratories), type of paper (clinical or technical), abstract of paper, and equipment needs (slide projector, etc.).

Edgewood's Biophysics Lab Switches 2 Chiefs

Lt Col Janice A. Mendelson, a Diplomate of the American Board of Surgery with an MD degree from the University of Pittsburgh School of Medicine, is the new chief of the Edgewood (Md.) Arsenal Biomedical Department, Biophysics Laboratory.

Lt Col Charles C. Berdjis, who held that position, has moved into the job she vacated as chief of the Wound Ballistics Department.

The Biomedical and Wound Ballistic Departments work closely on many research activities, including evaluation of wound-producing effects of projectiles, flame and incendiary materials; methods of pathology, surgery and physiology; and experimental procedures related to wounds.

Lt Col Mendelson received a master of medical science degree at the Ohio State University Graduate School. She is a Fellow of the American College of Surgeons and a member of Alpha Omega Alpha, an honorary medical fraternity. Author of more than 20 technical and professional papers, she is the daughter of Col (USA, Ret.) and Mrs. J. A. Mendelson.

Lt Col Berdjis had distinguished himself as a pathologist prior to his entry into the U.S. Army in 1956. Prior to assignment to Edgewood Arsenal, he was senior pathologist at Fort Detrick, Md.

In Switzerland, he was associated with the University of Geneva School of Medicine for two years as an assistant pathologist before he joined the University of Paris staff as an assistant and consultant pathologist in the School of Cancer.

In 1950, he moved to the Teheran Anticancer Center, Royal Palace, Iran, as chief and consultant professor, and from 1953 to 1956 was a lecturer and assistant professor at the Department of Pathology, University of California School of Medicine.

Author of numerous publications in medical journals, he is a member of the American Medical Association, American Society for Experimental Pathology, Radiation Research Society for Experimental Pathology, Radiation Research Society and Association of Military Surgeons.

A HEAVY-LIFT HELICOPTER Joint Services Requirements Conference recently brought together representatives of U.S. Armed Forces and the new Department of Transportation to discuss development of the large "workhorse" type of helicopters. Lt Gen Harry W. O. Kinnard (front row, center), CG of the U.S. Army Combat Developments Command, sponsor of the meeting, is flanked by Capt A. P. Sergeant, assigned to Chief of Naval Operations, and Dr. Ben Posmak, Navy Ships R&D Center. Back row (l. to r.) are Capt Dean Dverstall, Air Force Systems Command; Lt Col Dock H. Peques, Marine Corps Development Center; and Capt. H. S. McNatt, Coast Guard headquarters. High point of the conference was the creation of a Heavy-Lift Helicopter Joint Requirements Formulation Committee, which held its first meeting Feb. 27 at USACDC HQ.

Policies Redefined for Managing Labs

(*Continued from page 2*)

quired, the necessary authority to accomplish their plan, and the responsibility for results.

Administrative restraints are "subject to the degree of guidance and review necessary to maintain proper orientation of research efforts."

Selective management will be followed as a basic principle. Reporting systems to higher authority will reflect only that information determined by higher authority to be necessary for management to know the status of programs compared to formulated objectives and standards.

Tasks of significant size and complexity may require coordination of many segments of the organization, raising a need for central management through operating teams headed by a responsible individual as team chief, the AR provides. In such cases, the team chief will be given adequate authority.

Each R&D Center or laboratory "will have a principal mission or objective area in which it is expected to concentrate, lead and excell . . . [and] a maximum effort will be made to avoid undesirable duplication of effort."

Relative to providing the maximum feasible career advancement opportunities within the military R&D environment and mission-oriented objectives, the regulation stresses the Army graduate, postgraduate and postdoctoral training program, including participation in conferences and symposia.

"Every effort must be made to insure that scientists and engineers are utilized at their highest skill levels, consistent with mission requirements" as a function of a "positive manpower management program." This calls for a minimum of administrative positions and echelons of supervision and review.

Processing of nonscientific and nonengineering reports and related administrative tasks required of R&D scientific and engineering personnel also is to be reduced to a minimum. Effective manpower management also requires that:

"Provisions are made for the use of scientific and engineering staffs on related research tasks for outside government activities where practicable during periods of reduced program activity. Whenever outside work is pursued under a permanent arrangement, efforts should be made to have the government agencies concerned provide necessary scientific and engineering spaces."

STRATCOM Selects 15 To Take C&GS Course

Fifteen field grade officers assigned to the U.S. Army Strategic Communications Command (STRATCOM) have been selected to attend the Command and General Staff College at Fort Leavenworth, Kans.

To prepare them for duty as commanders and general staff officers at division, corps and field army levels, the officers will attend a 38-week course starting Aug. 16. The course is designed to develop analytical and decision-making ability, character, self-expression and the ability for teamwork.

Except for Lt Col Thomas H. Davis, all of the officers are majors, namely David S. Johnson, James W. Madden, Charles J. Heberle, Jerry H. Hogan, Kenneth M. Irish, Burton D. Jones, Richard E. Kuhr, Charles R. Lindsey, Thomas B. McDonald, Finis E. Schneider, Joseph J. Taylor, George E. Wien, Kenneth J. Wittenberg, and Payton R. McDonald.

Sprint Meets Test Objectives in Timed-Response Flight

Sprint missile capabilities to respond to maneuver commands within specified time limits were demonstrated during a recent test flight at White Sands Missile Range, N. Mex.

Sprint is the short-range missile being developed for the Sentinel System, a Communist Chinese-oriented antiballistic missile system managed by Lt Gen Alfred D. Starbird. Spartan, the second interceptor missile, will be able to engage attacking missiles outside the earth's atmosphere.

During the Sprint flight, the missile was ordered to execute various maneuvers. In each case, the time required for the missile to respond to the commands was monitored and sent back to the ground for recording on computer tapes.

Sprint is guided by ground-based radars. During each maneuver, aerodynamic and thermal measurements were obtained from on-board instrumentation to provide flight environmental data. The U.S. Army Sentinel System Command, Redstone Arsenal, Ala., reported that the missile met test objectives during the full-duration "stop-watch" flight.

Sprint development is being carried out by the Orlando Division of the Martin Marietta Corp. Western Electric Co. is prime contractor for the Sentinel System and Bell Telephone Laboratories is responsible for system design and development.

Moody Wins USABRL's 1967 Zornig Award

The 1967 recipient of the annual Col H. H. Zornig Award is William L. Moody, chief, Mechnical Branch, Service Division, U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md.

One of the two highest civilian citations made at USABRL, the Zornig Award recognizes outstanding individual accomplishment in technical, administrative, mechanical and other related fields.

The Zornig Award was established in 1959 in honor of Col H. H. Zornig, who was the USABRL commanding officer from 1935 to 1941, and was largely responsible for organizing the present USABRL structure.

The citation commends Moody for outstanding technical ability and administrative proficiency, which have augmented the productive capacity and technical capability of the Service Division of USABRL. He has been an APG employe for 27 years.

The Mechanical Branch of the Service Division functions in the fabrication and modification of instruments, models, prototypes and components required in the conduct of various USABRL projects.

William L. Moody

The unit also plans for the expansions and replacement of the facilities under the program of capitalization and modernization of equipment and machine tools. It likewise coordinates with the Proving Ground's Development and Proof Services shops in the fabrication and modification of heavy instruments and prototypes.

In 1941, when USABRL was in its infancy, Moody was employed as a machinist. His badge number at that time was 65, which is in marked contrast with the current figure of approximately 1,100 USABRL employes. Five years later, he was appointed supervisor of the USABRL Model Shop and in 1956 became chief of the Mechanical Branch.

Patent Processing for Materiel Command Inventors

By Edward J. Kelly

When a member of the Army scientific community gives birth to a new idea by producing an invention, and then starts thinking about a patent to protect his brain-child, he is somewhat like an expectant father waiting outside the delivery room—with many uncertainties about how well everything will turn out.

By way of explanation, he wants to know if the U.S. Government will be sufficiently interested in his creation to file a patent application. Will it survive the novelty examination by the U.S. Patent Office? Will he retain some interest in it? Will it bring financial advantages and professional recognition?

In the U.S. Army Materiel Command, those responsible for patent processing are of the opinion that the inventor is entitled to information on the administrative procedures required. In this respect, no single step is believed to be as determinative of the filing decision as is the proper evaluation of the invention.

Evaluation procedures used within Department of the Army research and development installations have been somewhat diverse in nature, with each laboratory establishing its own method. For the most part, the process has been an outgrowth of practices in effect at the time that most of the Technical Services were merged into the Army Materiel Command when it was established in the Army-wide reorganization in 1962.

Evaluation procedures until recently revised were formulated against a background in which an adequate staff of prosecution attorneys was presumed to be available, and in which most of the services performed by the Patent Office for government agencies were provided without fees.

In that background of the past, statutory authority was in existence which was popularly viewed as a fringe-benefit patent privilege for all employes of the United States. Under this legal provision, fees were not required to be paid by employes in connection with the filing and examination of patent applications, and issuance of a patent thereon if they granted a license to the government.

Attorney fees were payable to private practitioners when the cases were prosecuted by outside counsel. However, laboratories that supported a staff of patent attorneys were expected to prepare and file free applications for all inventor-employes. Such actions were considered to be implementations of the statutory patent benefits.

This practice had been initiated at a time when the number of inventions generated was low and the need for selective evaluation slight. Provisions of the free filing law included the requirement for a determination that the invention was "likely to be used in the public interest." Positive determinations of this nature were usually drawn from the research.

As time went on, this practice continued while the number of patent-seekers increased at Army in-house research and development activities. The result was a large backlog of invention disclosures waiting to be developed into patent applications.

All of the laboratories recognized the need for an evaluation procedure to reduce this backlog. Some laboratories delegated the responsibility to formal boards. Others left the responsibility to the patent prosecution staffs. Generally, both of these groups did an excellent job in the face of undefined criteria and poor guidelines hastily created to cope with the emergency of the backlog of disclosures.

When the Army Materiel Command came into existence, there was a backlog of more than 2,000 inventions awaiting evaluation. In addition, the rate of incoming disclosures considerably exceeded the rate of patent application output. Aggravating the situation was a continued decline in the number of government patent attorneys.

Another complicating factor was the new policy of the Patent Office aimed at acquiring a moderate level of self-supportability by increasing fees for all of the services it performs. These costs are established by Congress through the enactment of laws prescribing ceilings.

Legislation in 1965 marked the first fee increases in more than 30 years. Fees increased two- and threefold. More important to the Army, the law provided that government departments and agencies would pay for all Patent Office services. This included withdrawal of the free filing privilege for all U.S. Civil Service employes.

After Oct. 24, 1965, the Army Materiel Command was required to make payments to the Patent Office in accordance with the new rates. The impact was that AMC management no longer considered itself obligated to file patent applications for all of the inventions that were considered "likely to be used."

In view of these new factors, it was clear that a study should be made of filing policies and evaluation procedures. Action was initiated by reviewing the President's statement on government patent policy as promulgated by the Federal Council for Science and Technology.

The next step was an investigation of the policies and procedures used by various government departments and agencies. Finally, a study was made of filing procedures used in selected industrial corporations.

The White House statement issued in October 1963 established that the Executive Departments were expected to protect their invention rights in appropriate instances. Although the statement was addressed to the division of contractor inventions, it did set forth basic considerations for all government-originated inventions.

Clearly set forth in the statement was the concept that government-generated inventions constitute a valuable national resource, and that the use and practice of these inventions should, among other things, meet U.S. Government needs.

Prudent administration of federal R&D, it was further emphasized,

(*Continued on page 32*)

EDWARD J. KELLY is chief of the Patent Soliciting Branch of the Army Materiel Command, Patent Law Division, and formerly was chief of the Chemical Corps Patent Agency. He is a colonel in the Army Reserve Corps and for the past six years has commanded the 1610th U.S. Army Mob Des Detachment. He received a BS degree in chemical engineering from Drexel Institute of Technology in 1939 and an LLB from George Washington Law School in 1949. He is a member of the bars of the District Court and the Court of Appeals for the District of Columbia, the Court of Customs and Patent Appeals, and the Court of Claims. He is also admitted to practice before the U.S. Patent Office.

Patent Processing for Government Inventors

(*Continued from page 31*)

should include an invention disposition policy that was consistent with missions of the respective agencies.

During the studies of other Defense departments, it was revealed by the Departments of the Navy and the Air Force that their policy was to file patent applications on those inventions which were most useful in supporting their respective missions.

Navy decisions on whether an invention disclosure warranted a patent application were made by a centralized group whose evaluations were based upon mission and the size of the prosecution staff. The Air Force followed a similar policy which centralized determinations in Washington, D.C.

Patent management policies of industry were determined by studies of various publications. The consensus was that inventions generated in-house must be reviewed in respect to the corporate mission and the magnitude of coverage that can be expected from the Patent Office.

This latter policy is of considerable importance to industrial patent planning and is distinguished from government planning. The manufacturing firms must be able to exclude a wide band of imitiative competition if they are to invest profitably in the production of a new item of merchandise and develop a rewarding consumer demand for it.

The concept is known as an "offensive patent posture" and contrasts with the general Army posture of defensive patenting. The Army Materiel Command is interested primarily in being assured that it can operate freely in this monopolistic area to the extent necessary to fulfill its mission.

Within the government, the mission is first determined and then the effort is made to deny to nongovernment interests the ability to acquire exclusive rights in this area. Thus, although the criteria for evaluation are different, the evaluation exercise is substantially the same in government and industry.

The studies showed that industrial organizations had, in the main, employed committees to screen employe inventions and select those for which patent applications should be filed.

Committees usually consisted of representatives of affected departments who were knowledgeable of corporate policy to a degree that permitted value of the invention to be accurately appraised for potential profit. Members usually were research directors, production planners, sales managers, market analysts and economists.

Conclusions reached by the study group on filing policies and evaluation procedures delineated clear guidance lines. Inventions generated within the Army Materiel Command should be protected by patent coverage.

Further, coverage should be aimed at the more important inventions and of a magnitude commensurate with the capability of the patent prosecution staff.

Selection of the inventions should be accomplished by a committee serving as an advisory group to the commander. Members should be representative of the top technical management staff; also, they should be knowledgeable of the short-, mid- and long-range programs of their laboratories in order to compare the relative importance of invention disclosures.

Unlike industrial evaluations, where the facts are more sharply defined, the Army consideration of inventions often must be based upon plans for weapons and equipment continually subject to changing world conditions.

This is, at best, a most difficult assignment, but one that must be diligently pursued if the patent protection is to be meaningful and oriented to the mission of the command concerned with exploiting the invention.

The inventor's supervisor, or the supervisor of the art to which the patent pertains, may be called upon to advise on technical questions. The patent attorney may be requested by the committee to provide advice, including searching of the prior art to which the invention pertains.

In the case of the contractor-generated inventions, the views of the contracting officer's technical representative are also available to the

AFIP Museum Gains 6 Rare Historical Microscopes

An 1880 Hartnack microscope, one of the rarest and most beautiful made in the 19th century, has been donated to the Medical Museum of the Armed Forces Institute of Pathology (AFIP), Walter Reed Army Medical Center, Washington, D.C.

The Hartnack is one of six recently given to the museum by Hobart and William Smith Colleges of Geneva, N.Y. The others are a 1908 Bausch and Lomb, an 1895 R. B. Beck, an 1875 James W. Queen, and two of unknown origin produced around 1870.

The instruments have become part of the museum's Billings Microscope Collection. Believed the largest and most significant of its kind in the world, the collection traces the evolution of microscopes from 1590 to the present.

The Hartnack instrument was made in Potsdam, Germany, around 1880 by E. Hartnack, a nephew of Oberhauser, the famous German microscope manufacturer whose innovations include the horseshoe base.

Hartnack followed his uncle's design lines but concentrated more on craftsmanship. Although he did not make many microscopes, those bearing his name are recognized by European manufacturers as being among the finest early examples of the art.

AFIP Director Capt Bruce H. Smith, MC, U.S. Navy, said the Hobart and William Smith Colleges had done "a tremendous service" in donating the instruments, and that the museum is continuing to search for other Hartnacks. He added:

"A collection which presents the evolution of the microscopes, the instrument on which medicine and all life sciences rest, must give due [recognition] to the genius of Doctor Hartnack."

The Billings Microscope Collection, named for Lt Col John Shaw Billings, curator of the old Army Medical Museum from 1883 to 1893, was officially opened June 6, 1967. It is on display to the public at the Medical Museum, 7th St. and Independence Ave., S.W., Washington, D.C., from 9 a.m. to 5 p.m. every day.

evaluation committee, along with those of other sources that may be helpful in determining the priority of preparation of patent applications.

New procedures have been incorporated in Army Materiel Command Regulations 70–35 dated Dec. 22, 1967, and issued through Deputy for Research and Laboratories Dr. Jay Tol Thomas. It provides for an Invention Evaluation Board that will convene frequently enough to minimize the backlog of patent disclosures awaiting action. A list of evaluation guidelines is included to assist the board in making decisions.

One question that comes to the inventor's mind at this point is:

What happens to the inventions that are not selected to be patented?

Normally these are retired and retained for 17 years before the invention disclosure is destroyed. In this status they are available for early government use, in the event a claim is filed by a later inventor who has acquired a patent coverage on the same invention.

Some small protest may be raised that this policy is manifestly unfair, in that a patent is issued to other than the first inventor. From the viewpoint of the Patent Office, the first inventor is the one who first files an application that matures into a patent or who first publishes the invention.

The Army Materiel Command strives to get the best possible advantage from all inventions produced by employes, including those for which it is unable to file patent applications. Disclosures relegated to a retired status represent a good source of defense material which could be useful in subsequent claim actions.

In an effort to achieve patent status for more of the inventions generated by AMC inventors, the command permits them to file independently for patents on disclosures not selected for filing by the Invention Evaluation Board.

Under this arrangement, title to the invention remains with the inventor. The government limits its interest to a royalty-free license in the invention and the patent that issues thereon. This is in keeping with the President's Council for Science and Technology policy of fostering the fullest exploitation of inventions for the public benefit. Portions of this policy state that this interest might be served by according exclusive commercial rights to others in appropriate instances.

The Executive Order covering rights in employe inventions also contains a provision that the government interest might be served by according exclusive commercial rights to others in appropriate circumstances.

As stated in the order, in any case where the government has insufficient interest in an invention to obtain the entire rights title and interest (although the government could obtain same under the policy of the order), the agency concerned shall leave title to the invention in the employe, subject to approval of the Government Patents Board and reservation to the government of a royalty-free license.

At present, requests for affirmation by the government that title will be left with the inventor, because of an unfavorable evaluation of the invention, are being processed to the administrator of the Executive Order for approval.

Planned, however, is an effort to streamline the procedure by combining an evaluation statement by the evaluating board chairman with an expression by the inventor of willingness to file a patent application and to grant the required license. On the strength of these statements, approval could be given without use of a rights determination.

Interest of the Department of the Army in inventions for which it is unable to file patent applications is reflected also in the Incentive Awards Program. Eligibility requirements of AR 672-20 have been reviewed in the light of AMCR 70–35 as pertains to patent evaluation. In certain instances, privately filed applications are recognized as being within the scope of the AR.

In the future, inventions that have been evaluated as useful to the laboratory mission, but which are quantitatively in excess of the supporting patent attorney's workload, will be forwarded to the pertinent Incentive Awards Program committee. This action will follow the private filing of a patent application by the inventor, and the execution of the government license.

Under this plan, employe-inventors will become eligible for the $50 award that is granted for the filing of a patent application and for the $100 award granted upon the issuance of a patent.

Some inventors may consider it unfair for the government to require a license in those inventions for which it has determined not to prepare a patent application. Their contention is that when the government is not sufficiently interested to file an application, it should release all rights to the inventor willing to spend his money for a patent.

This contention is not soundly based. The government is in reality entitled to be recognized as the property owner of the invention if it is an outgrowth of the employe's work assignment. The government could acquire title whether or not it secured patent protection.

Secondly, the government is interested in the invention but it lacks the staff to file on all inventions of interest. Accordingly, it will normally protect itself by holding the invention in a retired status for a period in which it might be useful.

The government recognizes that a patented invention is of greater value to it than an invention in a retired status, and that a patented invention generally serves the public interest. It also recognizes that commercial rights might be of importance to the inventor. Consequently, the government is willing to enter into an agreement with the inventor to give him commercial rights in return for his private action to gain a patent. The government thus settles for the minimum rights used by it in the invention in return for having the invention covered by a patent.

If the government failed to retain an interest in the invention, the employe could initiate suit for infringement, and the last situation would be worse than the failure to require a licensing agreement.

In conclusion, it must be stressed that the U.S. Government is very much interested in the creative approach to problems, as demonstrated by inventions. Because of a shortage of patent-processing resources, patent coverage can be obtained on only carefully selected invention disclosures. Inventors who wish to file private patent applications on inventions not selected by the board are encouraged to do so.

Picatinny Engineer Represents Army At Quadripartite Ammunition Meet

Leon W. Saffian, chief of the High Explosive and Loading Section of Picatinny Arsenal's Ammunition Engineering Directorate, represented the Department of the Army at the recent quadripartite conference on the loading and assembling of ammunition in Sydney, Australia.

Saffian won an Army R&D Achievement Award in 1966 for work on the Safety Design Criteria Program. He recently returned to the Process Engineering Laboratory, following temporary assignment as head of the Aerial Mine Process and Equipment Engineering Group on a special project.

HumRRO Unit 7 Copes With Problem of Countering Insurgency

By Dr. Arthur J. Hoehn

One of today's major concerns for U.S. Armed Forces is helping friendly foreign governments counter active insurgency and threats of insurgency.

In both kinds of activity—the "fire-fighting" and the preventive measures—experience has shown that successful counterinsurgency requires the beleaguered government to develop adequate military or security forces. Perhaps even more important, successful counterinsurgency also requires social, economic and political development.

Members of the U.S. military are helping friendly governments with *both* kinds of development through U.S. Military Assistance and Advisory Groups (MAAGs), Military Missions, and Mobile Training Teams (MTTs). Assignment to any of these three "units" places special demands on a military man and requires that he have specific skills and knowledge.

First, a man in such an assignment must be able to communicate and to work effectively with host country personnel who may have values, assumptions, and ways of doing business which are quite different from those with which he is accustomed. Second, he must be effective in introducing innovations. Third, he must be able to adjust to new—often strange—physical and cultural environments.

These are the kinds of performance demands to which HumRRo Division No. 7 (Language and Area Training) is primarily directing its training research-and-development activities. HumRRo is an acronym which identifies the Human Resources Research Office of the George Washington University which, under contract, has served as the Army's principal training research agency for 16 years.

Current Division No. 7 projects for the Army include the following listed Exploratory Studies and Work Units. Exploratory Studies are essentially problem-defining activities undertaken in response to Army requirements. Work units are full-scale research efforts designed to produce specific information to help solve particular Army problems.

AREA TRAINING ES-40: *Troop Orientation in the Program of Korean Augmentation to the U.S. Army—KATUSA.* Dr. John W. McCrary is study leader of this program, started in 1950 as a means of augmenting U.S. Armed Forces fighting the Korean War. The KATUSA program continues today to provide training to selected members of the Republic of Korea Army and to maintain the full operating capabilities of U.S. units in that country. The program has obvious advantages for both the U.S. and Korean armies and there is continuing high interest in improving its effectiveness.

Dr. McCrary spent nearly three years in Korea and by means of field observation, interviews and questionnaires, has obtained considerable information about the day-to-day operation of KATUSA activities. The program operates with basic, "built-in" problems such as (1) differences in economic resources of U.S. and Korean personnel, (2) different privileges and restrictions, (3) different attitudes and expectations, and (4) communication barriers.

Several secondary problems stem from these basic problems. The quality of leadership provided in augmented units has served as the chief factor mitigating these conditions.

Preliminary reports have been submitted to HQ Eighth U.S. Army. At present, a report based on questionnaire surveys of approximately 400 Koreans and 400 U.S. personnel is being prepared.

ES-48: *Field Experiences of Military Advisers.* Under Samuel G. Taxis as study leader, HumRRO researchers are examining the feasibility of establishing a systematic Army "debriefing" system for officers and men who have performed military advisory duties in foreign countries.

Objectively, such a system would provide the Army with continuously updated information about adviser activities, problems, methods, adviser-counterpart interactions, and adviser adaptation to working and living conditions.

To define debriefing requirements and to identify practical means for meeting them, the researchers are conducting field studies overseas. In Panama at Fort Amador, Canal Zone, they helped the U.S. Army Southern Command develop an effective method for briefing and debriefing the Mobile Training Teams the Command sends to Latin American countries.

A second field study is now under way in Thailand where two HumRRO researchers are working with the U.S. Military Assistance Command, Thailand, to develop and implement a debriefing system. On the basis of field work, they hope not only to be able to assess the feasibility of a debriefing system, but also to sketch out tentative designs for such a system and to propose data collection methods and instruments.

ES-56: *U.S. Overseas Military Posts and Communities.* Dr. Harley M. Upchurch is study leader of this project. U.S. military personnel assigned to overseas missions often live in relatively self-sufficient "American communities" within the host countries. A better understanding of the characteristics of the communities should provide a basis for assessing these arrangements in terms of their implications for morale and mission accomplishment.

Still in a formative stage, the study is an attempt to define and evaluate possible directions for research on the general problem, to determine appropriate data-collection methods, and to identify locations where the desired data could be obtained.

Work Unit MAP: *Development of Guidelines for Training Personnel for Military Assistance Advisory Duties.* Dr. Arthur J. Hoehn, director of research, Division No. 7, is acting work unit leader. HumRRO's first study of adviser-counterpart relationships was

Dr. Hoehn joined the HumRRO staff in 1958, serving first as director of research, Division No. 1 (Systems Operations). Since 1963, he has been director of Division No. 7 (Language and Area Training). He attended Blackburn College, Carlinville, Ill., before transferring to the University of Illinois where he received BS (1940), MS (1947) and PhD (1950) degrees. A veteran of World War II service with the U.S. Army Air Corps, he was employed as a task leader and research administrator with the Air Force Personnel and Training Research Center until 1958.

☆U. S. GOVERNMENT PRINTING OFFICE : 1968 302-979/8

conducted by field survey in the Republic of China (Taiwan) in 1962. It dealt with the kinds of problems that arise in a military assistance situation, obstacles to the solution of these problems, and sources of information that led to action.

Findings from this initial study are reported in HumRRo Technical Report 65–5, *Adviser and Counterpart Activities in the Military Assistance Program in the Republic of China*, June 1965 (AD-478 352L).

Dr. Dean Froehlich, who conducted this MAP study on Taiwan, subsequently spent 32 months in Korea developing data collection techniques with which to study adviser-counterpart interactions in conjunction with the U.S. MAAG, focusing primarily on inter-personal factors.

The study involved personal characteristics and behaviors which make American advisers acceptable or unacceptable to Korean counterparts, and vice versa. When these analyses of the data collected have been completed, they should provide:

- A quantitative estimate of the extent to which advisers and counterparts in this one MAAG are generally satisfied with each other's performance and are willing to continue to work together;
- A list of the common mistakes advisers make while interacting with counterparts which tend to result in alienation;
- Identification of factors which appear to encourage or discourage the formation of effective relationships with his counterpart; and
- Estimates of the relative frequency with which various types of problems and obstacles occur in this MAAG.

In another MAP Work Subunit, HumRRO scientists are interviewing Army MAAG adviser returnees from both major and minor MAAG Groups to find out what they feel they have learned that would be worth passing on to others. The principal product of this effort will be a report on the problems that are frequently encountered in MAAG assignments.

WORK UNIT AREA: *Development of Concepts and Techniques for Area Training.* Dr. A. J. Kraemer is work unit leader of this project. Researchers hope to increase the effectiveness of the Army's area training programs by broadening concepts and by developing improved instructional techniques.

Investigators make a distinction between "area study," which is primarily concerned with teaching *about* a geographic or cultural unit (an information/knowledge approach), and "area training," which refers to all preparation for overseas effectiveness other than language and technical training. The focus of most of their effort is on awareness and sensitivity to the cultural factors involved in effective overseas performance.

This work unit has produced several reports. One provides a series of incidents that instructors may use to illustrate various types of difficulties the American is likely to experience overseas.

Another report evaluates existing knowledge and experience in the area of human relations training. It suggests ways in which such training can be used to prepare Americans to work with indigenous persons in overseas settings.

A third report, to be published shortly, describes a variety of resource materials which can be used in an area training program.

Perhaps the major activity in the work unit area has been development and preliminary assessment of a technique for simulating the cross-cultural encounter. A set of assumptions and values of American culture believed to be critical in cross-cultural interpersonal communication was conceptualized and a contrasting set developed. Actors were then trained to behave in a manner reflecting such "contrast American" assumptions and values.

A training technique was developed which involves confrontation between actor and trainee through the use of role-playing scenes in which the desired cultural contrasts are elicited. Preliminary evaluations suggest that this is a promising approach, particularly when presented as one part of a larger, well-integrated cross-cultural training program.

WORK UNIT CIVIC: *Guidelines for Civic Action Advisers.* Dr. Kraemer is work unit leader of this project, in which HumRRO researchers are attempting to develop guidelines for military advisers who are concerned with promoting the development of a civic action program by the host-country military.

Because there has been little uniformity among the duties performed by these advisers, the initial effort of this work unit has been conceptualization of the role of the U.S. military mission in a developing nation and objectives of civic action programs.

Dr. Kraemer has made field trips to U.S. military missions in Ecuador, Venezuela, Thailand and Iran. In Venezuela, he served as a participant-observer with a civic action Mobile Training Team. In addition, he has collected data from Army officers returning from civic action assignments in Laos, Vietnam, Bolivia, Peru, Guatemala and Iran.

As a result of his field trips and interviews, Dr. Kraemer believes that it is more useful to conceive the role of U.S. military missions in emerging nations as one of helping conditions that facilitate adoption of innovations, rather than as one of providing expert advice.

Areas particularly likely to deserve special attention are (a) organization development; (b) development of human resources; and (c) development of professionalism.

A technical report being written spells out how this concept applies to the promotion of civic action. It describes some of the obstacles that make it difficult for the host-country military to adopt civic action as one of their primary missions.

A second subunit of this effort is an attempt to identify factors that contributed to success or failure in past efforts to introduce new ideas and practices in traditional societies.

Language Training. The language training work of HumRRO Division No. 7 has consisted largely of exploratory development of programed self-instructional language courses.

Under *Work Unit MALT*, with Dr. A. I. Fiks as work unit leader, a short, taped, programed Vietnamese course for personnel preparing for duty in Vietnam has been developed and tested. The objective of this course is basic communication skill for purposes of: rapport establishment, advising, assisting, interpreter control and survival.

Work unit AUTOSPAN (Dr. G. H. Brown, work unit leader) is aimed at extending programed, self-instructional language training beyond the acquisition of very elementary skills for specialized purposes. Reading and writing will be covered as well as audio-lingual skills.

Work Unit REFILL (Dr. A. I. Fiks, work unit leader) consists of a survey of selected language training approaches and a study of student attitudes and motivation for foreign-language learning. Reports on these studies are now in preparation.

FLARE

UNIVERSITY OF FLORIDA
3 1262 09682 5756

Army Evaluates Amphibious Troop Carrier for Marine Corps

Interim reports indicate that the new XM759 Marginal Terrain Vehicles (MTV) being evaluated by the U.S. Army for the U.S. Marine Corps may prove one of the most effective troop carriers of its type ever tested.

The pilot models are amphibious and employ the air-roll principle for both land and water locomotion.

Intended for use in adverse terrain normally impassable to wheel and heavy tracked vehicles, the XM759 can accommodate 14 fully equipped combat troops or a 1½-ton rated payload. The suspension system consists of two individually driven tracks composed of 24-inch diameter, 21-inch-wide tires mounted on individual axles attached at both ends to drive chains.

Pneumatic action of the tires provides the only spring response to rough terrain, since the XM759's sponsons (side extensions designed to increase its lateral stability) either rest or ride on top of the tires, with no mechanical connection in between.

Large drive sprockets engage the track chains to propel the MTV. When traveling on firm ground or terrains possessing varying degrees of softness, the MTV's body rolls over the tires as though on a roller conveyor. When its operation is required in a marine environment, the carrier's wheels, serving as paddles, propel the vehicle through the water.

Technical resources and engineering skills of three major testing organizations of the U.S. Army Test and Evaluation Command (USATECOM), operating in conjunction with the Army Engineer Waterways Experiment Station (USAEWES), are involved in evaluating the XM759 prototypes.

Aberdeen (Md.) Proving Ground is responsible for land engineering, reliability and durability testing. Yuma (Ariz.) Proving Ground is testing the MTV's operational characteristics, under desert conditions.

The U.S. Army General Equipment Test Activity (USAGETA), Fort Lee, Va., has been assigned the responsibility for conducting water engineering, mobility and cargo-loading adaptability tests to determine the XM759's overall technical operation and safety characteristics.

Since the intensive testing schedule was initiated, USAGETA has utilized 11 testing sites in Virginia's "Wetlands" and the Mississippi Delta Region of Louisiana to investigate the MTV's speed, mobility, maneuverability and steering capabilities.

Both of these preselected sites, chosen by USAGETA AND USAEWES engineers, are noted for their varying soil consistencies, acres of tidal mud flats, heavily vegetated open water, and cluttered water tracts. They are quite similar to those that might be encountered in Vietnam or other wet, marshy environments.

In addition to supporting USAGETA in the selection of the testing areas, USAEWES assisted in obtaining soils measurement data, and analoging the MTV's performance during testing to predict the vehicle's performance in Southeast Asia.

Fifteen mobility courses were used and the XM759 completed 14 with and without a rated payload. The test vehicle proved capable of traveling over 44 different terrain types in the testing complex. The standard M116 full-tracked carrier, used for comparison of capability, traversed only 24 of the varied terrains.

According to a USAEWES soil analysis and survey findings, the XM759 was capable of negotiating soil having a rating cone index as low as 2 on Beauregard Island and at Bayou du Large, La.

Water engineering tests performed on the XM759 were conducted by USAGETA on predetermined courses laid out on the Appomattox River and the Chickahominy River, both in Virginia.

For these water speed and swimming trials, a flag rudder kit and four different sizes of rudders, were provided by the Army Tank-Automotive Command, designer and builder of the MTV.

The USAGETA designed and constructed a set of large 16-inch rudders for the swimming tests. Other water engineering evaluations performed on the test and control vehicles included static flotation and watertight integrity, maximum static roll and pitch angles, water towing resistance and water turning tests.

A 400-hour durability test, conducted in 100-hour cycles on Pilot Model No. 1 vehicle, is being performed to ascertain the XM759's endurance. The test calls for operation 20 hours in mud, 24 in swamp areas, 8 on smooth surface highways, 8 under secondary road conditions, 8 cross-country, 12 on hilly terrains and 20 for swimming evaluations.

On completion of the engineering tests, and provided the XM759 has been recommended as suitable for service tests, the experimental MTV will undergo this type of testing in a typical Marine Corps environment. This will include the Marine Base at Camp Lejeune, N.C., and the Panama Canal Zone. Factors relating to the MTV's operation and maintainability under simulated and actual field conditions will be tested by Marine units.

Operated by a 2-man crew, the prototype weighs about 11,500 pounds. It has a top speed of 7 m.p.h. over inland water and a maximum land speed of about 35 m.p.h.

An $8.5 million contract awarded in 1967 provided for advanced production engineering, production and engineering support. Delivery of 200 MTVs to the United States Marine Corps is expected to be completed by Dec. 31.

XM759 MARGINAL TERRAIN VEHICLE turns to climb onto firm ground after negotiating through swamplands in testing program at Morgans Island, La.